VIP MK3 / VIP SYSTEM3

USER MANUAL

SECURITY

- This instrument was manufactured and tested in conformity with IEC 348, the standards DIN 57411 Part 1/VDE 0411 Part 1, .Protective Measures for the Electrical Measuring Instruments. and left the factory in perfect technical safety conditions. For the purpose of maintaining these conditions and to guarantee safe operation, the user must adhere to the indications and warnings contained in the enclosed operating instructions.

- Before switching on the instrument it is necessary to verify that the operating voltage and line voltage set on the instrument coincide.

- It must be plugged into only a current tap with earth (ground) wire. This protective action must not be eliminated by using an extension cord without a protection conductor.
- The electrical plug must be inserted before the measurement and command circuits are disconnected.

- Warning!
  Any cut off of the protection conductor inside or outside the instrument, or detachment of the protection conductor connection can cause the instrument to become dangerous. No voluntary cut off is allowed.

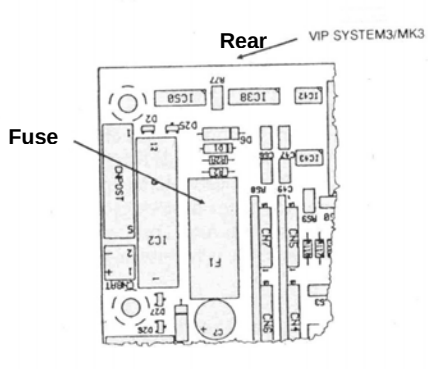
- During the opening of the covers or the removal of pieces with the exception of the cases in which these operations are carried out manually. live pieces can get skinned. The connection points can also be live. Before any compensation maintenance. repair or replacement of pieces. it must be detached from any power sources any time that it is necessary to open it.

- The capacitors can be loaded even after it has been detached from all power sources.
- It must be guaranteed that the replacement protections used are of the required amperage. The use of protections which have been repaired or short-circuiting of the fuse carriers is not allowed.

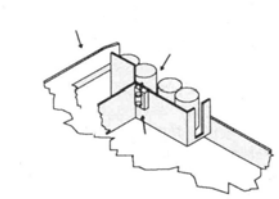
- After having determined that it can no longer operate safely, it must be taken out o! service and secured against involuntary operation.

Safe operation is no longer possible in the following cases -when the instrument shows clearly visible damage -when it no longer operates
-after lengthy storage in adverse conditions
-after serious damage caused during transport.

There are two protection fuses inside the instrument. Fuse F1= 5x20 1A type T mounted on the instruments P.C. Board for the protection of the logic circuits.



Fuse F2= 5x20 1A type T for the protection of the Ni-Cd batteries.



Maintenance and/or repair operations with the instrument open must be carried only by qualified, authorised personnel.

A - OPERATOR SAFETY .

Read these pages carefully before installing and using the instrument.

A.1 - INTRODUCTION

The instrument described in this manual is designed for use by suitably trained staff only.

Ali servicing and/or repairs which involve opening the instrument must be carried out exclusively by skilled, authorised staff.

A.2 - SAFETY PRECAUTIONS

For proper, safe use of the instrument and for servicing and/or repairs the staff authorised to carry out servicing and/or repairs must observe standard safety precautions.

A.3 -SYMBOLS

READ THE INSTRUCTIONS

A.4 - PRECAUTIONS IN CASE OF MALFUNCTIONS

If it is suspected that the instrument is no longer safe, for example because of damage during transport or use, it must be withdrawn from service and precautions must be taken to ensure that it is not used by mistake. Call in authorised technicians for checks and any repairs required.

B - INSTRUCTIONS FOR INSTALLATION

B.1 - PRELIMINARY CHECKS

On receipt of the instrument, check that it has not been damaged during transport.

If any problems are noted, contact the ELCONTROL service network for any repairs or replacements.

B.2 -SAFETY INSTRUCTIONS

B.2.1 -GROUNDING

Before any connections are made the instrument must be grounded by means of the power supply plug, which must be inserted only in sockets complete with ground connections.
Power lead extensions may only be used if these ensure that the power supply (mains) connection is maintained.

B.2.2 - SUPPLY VOLTAGE

The instrument can be supplied at a voltage range between 200V and 240 V; 50/60 Hz (100 V -120 V. 50/60 Hz on request).

For a supply voltage range 200 V- 240 V use fuses 80mA 250V type T (160 Ma type T for 100V-120 V operations). Disconnect the power lead before changing the fuse. The fuse holder is located on the rear panel beneath the power socket. If the fuse requires replacement, proceed as follows:
-Remove the fuse-holder lid using a screwdriver.
-Insert a new fuse with the same specifications and close the fuse holder.

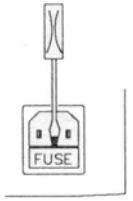


Fig .B.1

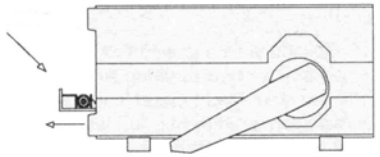


Fig. B.2

Ensure that only fuses with the same voltage and current ratings as the originals are used.
Repaired and/or short-circuited fuses must never be used.

B.3 - BATTERY OPERATION

A 5 V 1300 mA Ni-Cd battery (consisting of 4 elements of 1.25 V 1300 mA connected in series) will supply the instrument for 3 hours with the internal printer and display illumination switched off. IMPORTANT
When the instrument is running on the battery the ground connection is not required and therefore MUST NOT BE CONNECTED. The internal battery automatically recharges in 48 hours when the instrument is connected to the power supply (mains), or it can be recharged in about 60 minutes if the FBC1 module is connected to the socket provided.
N.B. Remember that when the FCB1 battery charger is used the automatic power supply (mains) charging function is disabled.

1 **DESCRIPTICN CF THE INSTRUMENT**

1.1 WHAT IT CAN DO

The VIP SYSTEM 3/ MK3 are the result of experience drawn from two previous ELCONTROL instruments of the same type (the VIP and the MICROVIP). whose excellent features they retains. However. they also incorporate very important innovations which make them truly new instruments.

They monitor all three phases of a three-phase system.

They are portable, light-weight device with built-in 40-column printer.

The VIP SYSTEM 3/ MK 3 can run on batteries and can measure no less than 81 electrical parameters with very high accuracy.

In particular, the VIP SYSTEM 3/ MK 3 are capable of measuring parameters not generally covered by an instrument of this type: they measure harmonic distortions; indicate average values and record maximum readings for various parameters; they measure and print out active and reactive power consumption; and record micro interruptions in the power supply (mains) and the duration of longer interruptions.

The built-in printer is capable of printing measurement data on request and can provide automatic print-out of the sequence of measurements relative to any four parameters selected by the operator.

The instruments. printers can also provide bar graphs plotting 2 of the parameters measured: they also provide rapid print-out of the value of those parameters which cross the alarm thresholds and monitor their development with frequent print-out until they come back inside the preset limits.

Alarm monitoring is made more effective by two RELAY outputs activated when an alarm threshold is crossed.

1.2 EASY TO USE

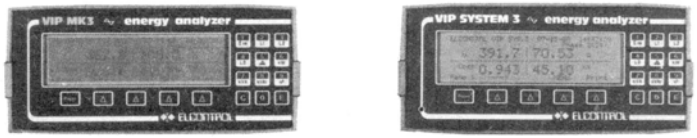
This brief description may give the impression that use of the instrument is very complex: in reality, procedures far measurements relating to most of parameters are quite straight forward.

The instrument is supplied by the factory already set up far monitoring mast of the parameters relative to an electrical user.

The supporting hardware supplied with the instrument comprises a set of voltage measurement connection cables, three clamp meters far current measurement and various accessories.

The VIP SYSTEM 3 / MK 3 and their accessories are preset with default program data ready for immediate operation: they can be used straight away to measure electrical power in Low Voltage systems (up to 600 Volts between phases and neutral) with phase current up to 1000 Amps.

When the instruments are switched on, the measurement cycle starts immediately and the display shows the first measurement page covering three phase voltage. current. active power and CO~ parameters (see fig. 1.1).



All setting and selection procedures are carried out by means of a small numerical keyboard and 4 function keys on the front of the instrument. The function key with the symbol relating to the parameter required is pressed to call up one of 10 different display pages, which show the 81 parameters the instrument is capable of monitoring.

The measurements displayed (updated every second) are the following

Page 1 -*Voltage, current, Cosø, three phase power.*
Page 2 -*Voltage, current, Cosø, power of phase L* 1 *(R)*
Page 3 -*Voltage, current, Cosø, power of phase L2 (S)*
Page 4 -*Voltage, current, Cosø, power of phase L3 (T)*
Page 5 -*Three voltages, neutral current, frequency, phase rotation of each phase and three-phase*
Page 6 -*Instantaneous, average and maximum active power of the three phases and three-phase*
Page 7 -*Instantaneous, average and maximum apparent power of the three phases and three-phase*
Page 8 -*Instantaneous, average and maximum reactive power of the three phases and three-phase*
Page 9- *Percentage harmonic distortion of the three phases and three-phase.*
Page 10- *Active and reactive power consumption, average Tg and average Cosø of the three phases and three-phase.*

The measurements shown on the display can be printed by pressing the function keys under the word **PRINT** in the last line of the display.

The next function key (beneath MENU) is pressed for access to the function programming and measurement selection procedure.

Even if we are now presented with a very large range of options, management of these procedures is very simple thanks to the menu's tree structure. the operator-instrument dialogue.
Movement through the tree structure is by means of the numerical keys and the function keys. The specific function of the function keys are always indicated on the last line of the display page. (See Fig. 1.2)

For example, the function key located under "BACKPAGE" is pressed to turn back one page in the MENU branch, while the function key under IIMEASURE" takes the operator back to measurement page 1.

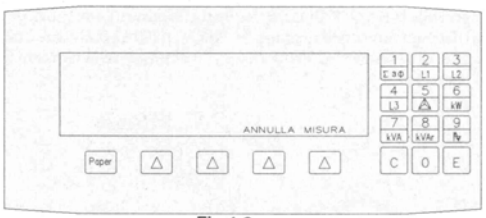


Fig.1.2

1.3 HIGHLY VERSATILE

The main feature of this instrument, and the factor which makes it unique of its kind, is its outstanding versatility and expandability.

The range of parameters monitored can be extended: for example. a special interface provides current measuring capacity from 30 mA to 999 kA.

Other interfaces allow accurate readings to be obtained even with current transformers *(CT)* other than the clamp meter provided. with different ratios.

In the same way, a special interface can be combined with the system's voltage transformers (VT) for medium voltage measurements.
Direct current measurements can be made using a special interface and clamp meter.

The VIP SYSTEM 3 / MK 3 can be connected to the telephone line using a MODEM device to permit remote processing of data from a number of analyzers.

A special accessory (MEMORY PACK) allows a larege number of measurements to be stored and then transferred to a remote printer or a computer.

Finally, the VIP SYSTEM 3 can be used to measure different types of parame ters far specific purposes through the installation of special BLACK BOXES.

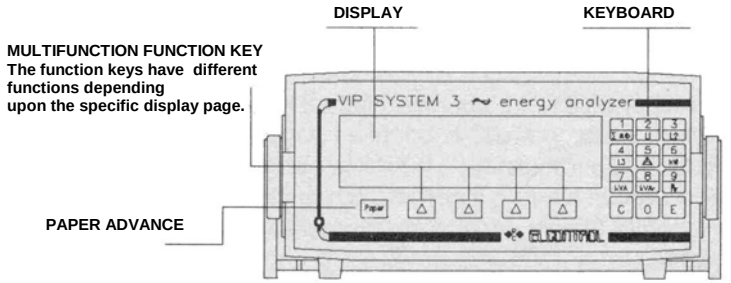
The BLACK BOXES for measurement (by means of a prometer) of temperature in the range from -20 o C. to + 200 o C (- 4 o to + 424 °F) ., and of system leakage current, respectively, are already available.

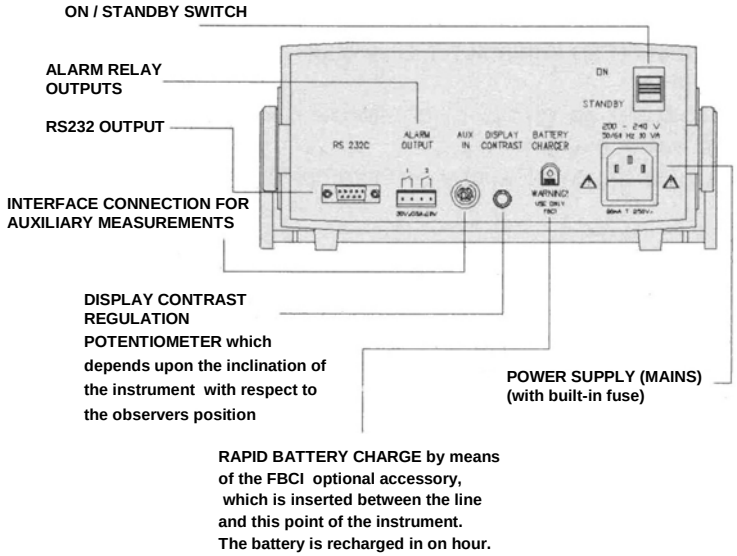
1.4 FEATURES AND APPLICATIONS

The VIP SYSTEM 3 / MK 3 are therefore intended to provide electricity consumers with in-depth information about their plant. But they are equally useful for design engineers, fitters, service technicians and electricians for faultfinding, repair and restructuring in plants already in operation.

- The VIP SYSTEM 3 / MK 3 can be used in the following applications:
- Load mapping
- Overload reduction with correspondingly reduced current leakage
- Checking new buildings and processes for design loading Improving safety standards through overload identification
- Accurate resolution of power factor correction problems.
- Elimination of load peaks
- Time period monitoring for optimum tariff utilisation
- Monitoring high frequency marine and avionics supplies
- DC measurement
- PWM/PAM monitoring

1.5 DESCRIPTION




ON / STANDBY SWITCH
ALARM RELAY OUTPUTS
RS232 OUTPUT
INTERFACE CONNECTION FOR AUXILIARY MEASUREMENTS
DISPLAY CONTRAST REGULATION POTENTIOMETER which depends upon the inclination of the instrument with respect to the observers position
POWER SUPPLY (MAINS) (with built-in fuse)
RAPID BATTERY CHARGE by means of the FBCI optional accessory, which is inserted between the line and this point of the instrument. The battery is recharged in on hour.
ON
STANDBY
RS 232C
ALARM OUTPUT
AUX IN
DISPLAY CONTRAST
BATTERY CHARGER

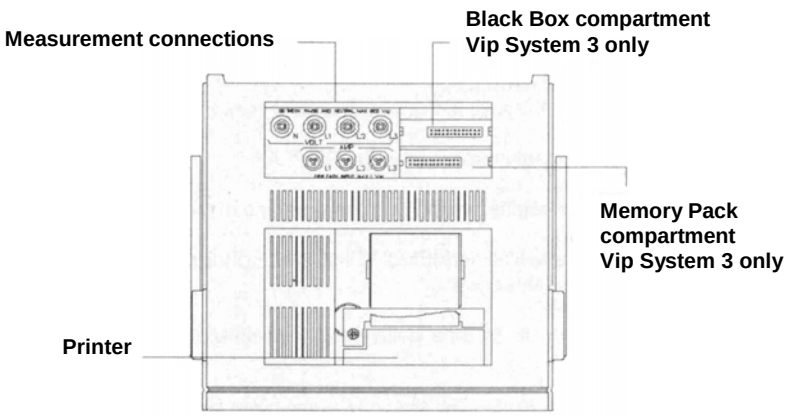
SELECTION ANG PRESETTINGS CARRIEQQUT ON THE KEYBOARD

- KEY NUMBER for guided Selection inside the MENU to Insert chosen presettings
- KEY SYMB0L indicated to what measurements the measurement display page refers (In this case [= Three-phase measurements of (V-I-Cosø-KW on page 1)

CLEAR cancels the existing presettings

ENTER confirm the posted presettings the moves to the following presettings

TOP VIEW



DISPLAY Alphanumerical and graphic high contrast LCD display complete with badlight for night-time illumination. The display is divided into 81ines of 40 characters: the first 7 are for menu messages and measurements; the last indicates the functions of the 4 function keys beneath.

KEYBOARD Tactile keypad with 12 keys, 9 divided into two parts of different colours, the upper section numbers used for menu selections and the lower part the symbols of measurements shown on the display.

PRINTER Impact printer, 40 alphanumerical characters, 1.5 print lines per second, capable of providing plotter and graph print-outs.

MEMORY PACK External module which can be inserted in the instrument or in a special compartment. connected by a connector. Contains a RAM memory of 128 or 512 kBytes with lithium buffer battery for storage of measurements. which are retained for up to 5 years.-Suitable for VIP SYSTEM 3 only-

BLACK BOX Composition varies according to function. Generally comprises a circuit with memory containing the application program. measuring method and menu pages for the specific function. -(Suitable for VIP SYSTEM 3)

FUNCTION KEY FUNCTIONS AS INDICATED ON DISPLAY

As mentioned above. the function keys take on different functions depending on the page shown on the display.
Four symbols on the bottom line of each page indicate the functions provided at the moment by the respective function keys beneath them. These are interpreted as follows:

-> Turn to next page.

<- Return to the previous page (tram measurement pages)

MENU Turn to the MAIN MENU page which is the starting point for all procedures.

PRINT Print-out of the readings shown on the display

m k M Multiplier of the unit of measurement shown on the display**.**

M k m Divisor of the unit of measurement shown on the display

STOP Halts MEMORY PACK transfer.

BACKPAGE Return to previous page (from menu pages).

MEASURE Return to measurement page 1.

MODIFY Access to serial line modification page

RESET Access to RESET page (from survey programming page)

FORWARD Access to next measuring survey.

DISPLAY Selects display illumination adjustment page.

BEEP OFF Halts acoustic hot-spot tracer signal.

1.6 KIT SUPPUED WITH INSTRUMENT

The kit of equipment supplied with the VIP SYSTEM 3 / MK 3 is all contained in a sturdy case with foam inner lining for added protection. Fig. 1.3 below shows the complete contents of the case and the location of the various accessories.

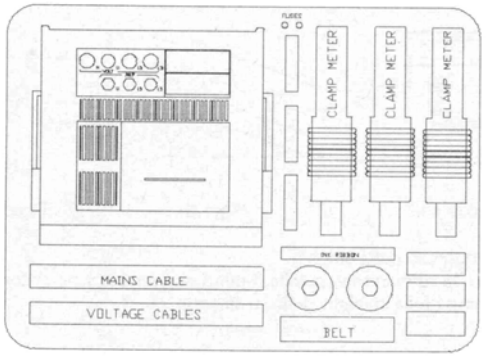


Fig.1.3

- **POWER SUPPLY (MAINS) CABLE** = Instrument feed cable
- **VOLTAGE CABLES** = 4 cables (with double insulation) for voltage measuring connections.
- **CLAMP METER** = 3 clamp meters with range 0-1000 Amps
- **BELT** = Instrument carrying-strap
- **INK RIBBON** = Spare ink ribbon for printer.
- **PAPER ROLL** = 2 spare rolls of paper for printer.
- **FUSES** = 2 spare fuses

Spaces to house 3 **MEMORY PACKS** and 3 **BLACK BOXES** are also provided.

1.7 HANDLING THE INSTRUMENT

Adjustable handle
Used for lifting the instrument. AIso acts as an adjustable rest for the instrument on the working surface.
The handle can be adjusted through 3200 from the rest position on a series of catches.

Fig.1.4

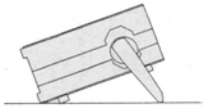


Fig.1.5

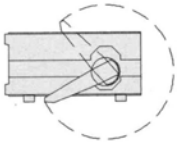


Fig.1.6

Carrying-strap connecting hooks.
Used when the instrument is to be carried on the carrying-strap.
The hooks are connected to special slots on the instrument's handle.

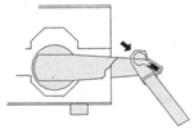


Fig. 1.7

Access to printer. By opening the pane' on the top of the instrument. Using the thumbs, push on the ridged area on the lid in the direction shown in the illustration.

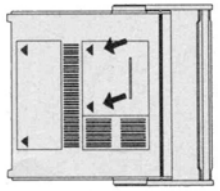


Fig.1.8

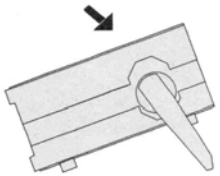


Fig 1.9

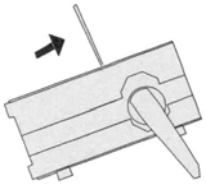


Fig 1.10

Changing the ink ribbon.
Open the printer compartment. Press on the word PUSH and slide out the ribbon. Fit the new ribbon, pushing down slightly.

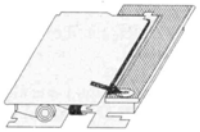


Fig.1.11

Changing paper roll.
Open the printer compartment. Press on the word PUSH and slide out the ribbon. Fit the paper as shown in Fig. 1.12 pressing the PAPER pushbutton several times. Replace the ribbon and check paper alignment.

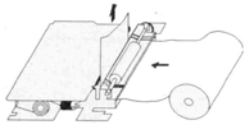


Fig.1.12

Access to connectors for connection of voltage measuring cables and clamp meters. Open the panel on the top part of the instrument (procedure as for printer compartment). This gives access to the connector panel as indicated in Fig. 1.14. There are 4 single-pole connectors for the voltage measuring connections, marked as follows:

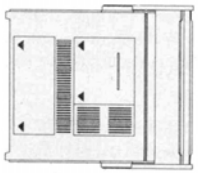


Fig.1.13

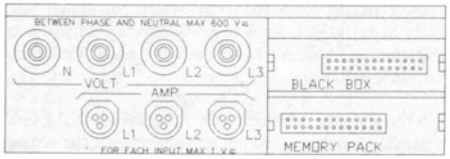


Fig.1.14

N for connection of neutral (if any)
L 1 for connection of phase R
L 2 for connection of phase S
L 3 for connection of phase T

There are also three three-pale connectors far connection of the three clamp meters: these are marked L 1, L2 and L3 respectively.

The right-hand part of this section houses the compartments containing the connectors far the Memory pack and Black Boxes.(VIP SYSTEM 3 only)

1.8 POWER SUPPLY ANO CONNECTION

The instrument is suitable for use on a power supply (mains) of 200 -240 V 50/60Hz. (100- 120 V 50/60 Hz on request). Connection is via the IEE socket on the rear panel. (see Fig.1.15)

Fig.1.15

The instrument may also be powered by its built-in rechargeable battery: the battery circuit is automatically connected when the power supply (mains) plug is removed.
The instrument is supplied directly by means of the power supply (mains) lead
and fuse with no intermediary switches.
The ON/STANDBY switch affects only the internal low-voltage circuit and the battery. In ON position the instrument is operative. while in STANDBY it is switched off but the battery- charging circuit continues to receive power.

At this point it only remains to connect the instrument to the circuit at the points where the measurements are to be made. For Low Voltage three-phase systems, this involves simply connecting the voltage measuring cables to the three phases and the neutral (if any) and the three clamp meters to the three phases.
For a more complete description of the voltage measuring connections required in the various cases please turn to paragraph 3.1.2.

The instrument will now start taking measurements when the switch contact is made (ON position). The readings will be shown on the display in real time, and updated every second.

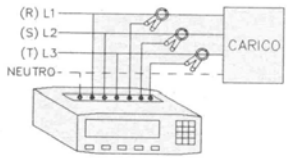


Fig.1.16

1.9 STARTING MEASUREMENT FUNCTION

The measurements of all the load's electrical parameters (and some other non-electrical parameters) can be shown on the instruments display panel. as explained in detail in paragraph 2.1.

For access to display measurement page 1 from other pages. simply press the far right-hand pushbutton (beneath the word MEASURE at the bottom of the page).

From page 1 access to pages- 2 to 9 is obtained by simply pressing the corresponding numbered key (see Fig. 1.17)

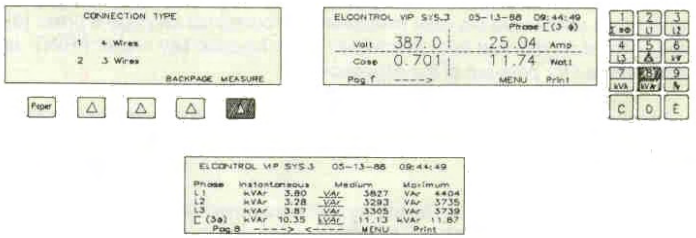


Fig. 1.17

For access to measurement pages 10 to 14 from any measurement page press [E] followed by the key bearing the second figure of the number (see Fig. 1.18)

Fig. 1.18

1.10 MANUAL PRINT-CUT CF MEASURED DATA

The bottom line of the display always indicates the function of each of the 4 function keys immediately below. With a measurement page on the display, the function key on the far right is pressed for manual print -out of the measuring data shown on the display in that moment.

Let us suppose for example that we are on any one of the measurement pages: to obtain a print-out of the data measurement contained on page 9 press [9] to call the data required onto the display. The function key under IIPRINT" is then pressed for print-out of the data shown.

Apart from manual print-out of one page at a time, the instrument can provide overall print -out of all the latest measurement data (contained on the 14 display pages.)

To obtain overall print-out from any one measurement page, simply press the function key under "PRINT" (far right) twice.

2 OPERATING OPTIONS

As mentioned in the introduction, the VIP SYSTEM 31 MK 3 can provide a large number of functions.

2.1 DISPLAY INDICATION OF MEASUREMENTS IN PROGRESS

The first 10 display pages show the measurements of 81 electrical parameters. In addition, on display pages 15 and 16 the instrument indicates any measurements of non-electrical parameters made using special transducers and the appropriate black boxes. (VIP SYSTEM 3 only)

If the operator has programmed the tariff time bands into which the day is to be divided, display pages 11,12,13 and 14 will provide 64 measurements of active and reactive power, (average Coø and Tgø» in the various time intervals.

- The instantaneous readings are updated every second.
- The average values are calculated over the time period preset by the operator, and are updated continually.
- The maximum measurements are stored until exceeded.
- Each display measuring page indicates the following data:
- Date and hour, continually updated.
- Identification of phase or three-phase indication.
- Parameter being measured: parameter reading and unit of measurement.
- Time band indication.
- Display page number.
- Functions of function keys beneath display.

DISPLAY PAGES AND PARAMETERS SHOWN

Phase Σ(3φ) V-Σ A-Σ Cosφ-Σ kW-Σ	Pag 1	V-Σ Phase to phase voltage value (average of three phases) A-Σ Equivalent current value of three-phase system Cosφ-Σ Power factor of three-phase system kW-Σ Active power of three-phase system
Phase L1(R) V-1 A-1 Cosφ-1 kW-1	Pag 2	V-1N True voltage between L1 phase and neutral A-1 L1 phase true current Cosφ-1 L1 phase power factor kW-1 L1 phase active power
Phase L2(S) V-2 A-2 Cosφ-2 kW-2	Pag 3	V-2N True voltage between L2 phase and neutral A-2 L2 phase true current Cosφ-2 L2 phase power factor kW-2 L2 phase active power
Phase L3(T) V-3 A-3 Cosφ-3 kW-3	Pag 4	V-3 True voltage between L3 phase and neutral A-3 L3 phase true current Cosφ-3 L3 phase power factor kW-3 L3 phase active power
V-12 V-23 V-31 A-N Hz	Pag 5	V-12 V-23 V-34 Voltage value between the phases A-N N phase current Hz Frequency
Phase Inst. Av. Max. L1 kW kW kW L2 kW kW kW L3 kW kW kW Σ(3φ) kW kW kW	Pag 6	Instantaneous-average and maximum active power of each phase and of entire three-phase system. (average values are calculated over a preset time)
Phase Inst. Av. Max. L1 kVA kVA kVA L2 kVA kVA kVA L3 kVA kVA kVA Σ(3φ) kVA kVA kVA	Pag 7	Instantaneous-average and maximum active power of each phase and of entire three-phase system. (average values are calculated over a preset time)
Phase Inst. Av. Max. L1 kVAr kVAr kVAr L2 kVAr kVAr kVAr L3 kVAr kVAr kVAr Σ(3φ) kVAr kVAr kVAr	Pag 8	Instantaneous-average and maximum reactive power of each phase and of entire three-phase system. (average values are calculated over a preset time)
Phase Inst. Av. Max. L1 % % % L2 % % % L3 % % % Σ(3φ) % % %	Pag 9	Instantaneous-average and maximum harmonic distortion of each phase and of the entire three-phase system. (average values are calculated over a preset time)

Phase kWh kVArh Cosϕ Tgϕ		
L1 L2 L3 Σ(3ϕ)	Pag 10	kWh Active energy consumption (for each phase and total) kVArh Reactive energy consumption (for each phase and total) Cosf Average power factor (for each phase and total) Tgϕ Average power factor correspondent (for each phase and total)

Pages Displayed Only If Time Tariff Periods Programmed

Phase kWh kVArh Cosϕ Tgϕ		
L1 L2 L3 Σ(3ϕ)	Pag 11	kWh Active energy consumption (for each phase and total) kVArh Reactive energy consumption (for each phase and total) Cosϕ Average power factor (for each phase and total) Tgϕ Average power factor correspondent (for each phase and total) (Time band 1)
Phase kWh kVArh Cosϕ Tgϕ		
L1 L2 L3 Σ(3ϕ)	Pag 12	kWh Active energy consumption (for each phase and total) kVArh Reactive energy consumption (for each phase and total) Cosϕ Average power factor (for each phase and total) Tgϕ Average power factor correspondent (for each phase and total) (Time band 2)
Phase kWh kVArh Cosϕ Tgϕ		
L1 L2 L3 Σ(3ϕ)	Pag 13	kWh Active energy consumption (for each phase and total) kVArh Reactive energy consumption (for each phase and total) Cosϕ Average power factor (for each phase and total) Tgϕ Average power factor correspondent (for each phase and total) (Time band 3)
Phase kWh kVArh Cosϕ Tgϕ		
L1 L2 L3 Σ(3ϕ)	Pag 14	kWh Active energy consumption (for each phase and total) kVArh Reactive energy consumption (for each phase and total) Cosϕ Average power factor (for each phase and total) Tgϕ Average power factor correspondent (for each phase and total) (Time band 4)

2.2 INSTRUMENT PRINT OPTIONS

The printer incorporated in the instrument provides print -out of measured data in one of the following ways:

Manual print-out of the data which appear on the display
The operator obtains print-out of the data indicated on the display as shown in fig.2.1 ; the tape also carries the date, time and page number.

Overall print-out (requested by the operator) by pressing twice the print function key of all the most recent measurements taken and stored by the instrument. As shown in Fig. 2.2, overall print-out does not include average power and energy readings for the various time bands if the operator has not made the necessary presettings.

Timed local print. Automatic print-out of the measurements for 4 parameters selected by the operator.
Under this mode the instrument stores 24 measurements (taken at a preset time interval) and then prints them, without further operator instructions.
The operator selects the 4 parameters for timed local print from among the 63 electrical parameters (plus the auxiliary parameters).
This print mode is used to monitor a small number of parameters over relatively long periods of time (many hours).
However, partial data may be obtained by interrupting the timed print sequence and requesting immediate print-out of the measurements recorded so far (see Fig. 2.2).
After this print-out (obtained using the FORCED PRINT procedure) the instrument starts taking a new cycle of 24 readings for the next timed print-out.

MANUAL Pase 1 05-07-88 08:57:59
Σ(3φ)

V	166.6	I	A	287.6
Cosφ	0.384	I	kW	18.23

MANUAL Pase 1 05-07-88 08:58:18
Σ(3φ)

V	166.4	I	A	287.8
Cosφ	0.385	I	kW	18.26

MANUAL Pase 10 05-07-88 08:58:35
Total

	kWh	kVArh	Cosφ	Tg.φ
L1	01.955211	06.438405	0.291	3.293
L2	01.959611	06.440895	0.291	3.287
L3	01.941391	06.441366	0.289	3.318
Σ(3φ)	05.856213	19.319866	0.290	3.297

Fig. 2.1 Manual Print-Outs

05-07-88	V-1N	V-Σ	VA-Σ	VAr-Σ
16:52:22	222.6	11.49k	11.67k	2049
16:53:22	223.2	11.57k	11.75k	2070
16:54:22	223.2	11.68k	11.88k	2073
16:55:22	224.0	11.59k	11.78k	2054
16:56:22	223.1	11.63k	11.83k	2060
16:57:22	224.2	11.68k	11.87k	2081
16:58:22	223.1	11.71k	11.90k	2089
16:59:22	224.6	11.61k	11.80k	2060
17:00:22	221.7	11.55k	11.73k	2052
17:01:21	221.3	11.37k	11.55k	2012
17:02:21	222.7	11.48k	11.66k	2016
17:03:21	222.0	11.41k	11.68k	2021
17:04:21	221.6	11.40k	11.58k	2017
17:05:21	222.8	11.45k	11.63k	2016
17:06:21	221.2	11.41k	11.58k	2021
17:07:21	221.2	11.35k	11.51k	1993
17:08:21	221.7	11.40k	11.57k	2006
17:09:21	221.5	11.39k	11.59k	2008

Fig. 2.2 FORCED AUTOMATIC Print-Outs

After 18 print records at.17.09 hrs 21 sec the operator request immediate print-out
Of measurements already recorded

OVERALL 08-09-88 11:09:17
Frequency 50.0 Hz
Auxiliary
Phase Rotation OK
Current

Phase	L1	L2	L3	Σ(3φ)	N
A	74.6	70.1	70.3	71.60	6.61

Voltage

Phase	1N	2N	3N	Σ(3φ)
V	209.2	209.8	210.0	363.2

Phase	12	23	31
V	362.9	363.6	363.0

Power Factor

Phase	L1	L2	L3	Σ(3φ)
Cosφ	0.862	0.896	0.986	0.888

Active Power (P)

Phase	Instant.	Average	Maximum
L1	kW 13.45	kW 13.47	kW 13.55
L2	kW 13.18	kW 13.21	kW 13.28
L3	kW 13.37	kW 13.41	kW 13.50
Σ(3φ)	kW 40.00	kW 40.02	kW 40.25

Apparent Power (S)

Phase	Instant.	Average	Maximum
L1	kVA 15.61	kVA 15.68	kVA 15.78
L2	kVA 14.71	kVA 14.76	kVA 14.83
L3	kVA 14.76	kVA 14.85	kVA 14.93
Σ(3φ)	kVA 45.04	kVA 45.29	kVA 45.54

Reactive Power (Q)

Phase	Instant.	Average	Maximum
L1	kVAr 7.92	VAr 8038	VAr 8175
L2	kVAr 6.53	VAr 6548	VAr 6568
L3	kVAr 6.25	VAr 6335	VAr 6598
Σ(3φ)	kVAr 20.70	kVAr 20.90	kVAr 21.25

Distortion Factor

Phase	Instant.	Average	Maximum
L1	% 0.06	% 0.14	% 0.14
L2	% 0.00	% 0	% 0
L3	% 0.00	% 0	% 0
Σ(3φ)	% 0.02	% 0.05	% 0.05

Total

	kWh	kVArh	Cosφ	Tg.φ
L1	01.955211	06.438405	0.291	3.293
L2	01.959611	06.440895	0.291	3.287
L3	01.941391	06.441366	0.289	3.318
Σ(3φ)	05.856213	19.319866	0.290	3.297

Fig. 2.3 OVERALL PRINT-OUT

Energy consumption values for the time intervals appear only if the operator has set the times for each time band. Total energy consumption values appear in all cases.

2.3 TIMED LOCAL PRINT ALARMS

As has been seen, timed print-out is used above all for long-term monitoring at fairly long time intervals.
However, more intensive monitoring of phenomena which start and finish during the interval between two print-outs may be appropriate.
In this case, the instrument must be set to take more frequent readings during the periods in which it is believed that these phenomena may occur.
The timed print function therefore includes the option of setting periods of tirne within which the print-out time interval is shorter.
This instrument function, which is activated using the alarm procedure, is called hour alarms.

The print-out interval may also be reduced if the parameters being monitored in the timed print-out mode pass the preset alarm thresholds (minimum or maximum alarms).

In both cases the print-out ti me interval automatically changes to the alarm interval, preset by the operator during SET UP

The print-out tape shown in Fig. 2.4 indicates how the print- out interval becomes shorter during alarm periods. (The [> * <] signs in the string indicate that the value has passed the alarm threshold. Respectively: > start of alarm, * value still in alarm, > end of alarm).

2.4 **RATE TIME BANDS**

When the user is charged different tariff at different times of day, active and reactive energy counters may be used to come into operation during programmed time bands.
A time band is a period of the day which can be programmed between 00.01 and 23.59 hours, during which the energy values will be recorded not only on the total meters but also on the time-band meters.
Time bands cannot be overlapped but intervals may be left between them. The tariff band energy counters provide energy totals only during the period of the day included in the band. and are reset by the meter rest procedure.
A maximum of 4 tariff bands can be set during the day, but the energy consumed during the period not covered by the tariff bands can be obtained by subtracting the band meter totals from those of the overall meters, giving a fifth tariff band which may also consist of different periods distributed through the day.

05-07-00	V-1N	W-Σ	VA-Σ	VAr-Σ
17:22:31*	222.6	11.41k	11.58k	2089
17:22:51*	222.6	11.46k	11.63k	2026
17:23:11*	223.1	11.52k	11.69k	2039
17:23:31*	223.0	11.56k	11.73k	2051
17:23:36<	236.7	11.61k	11.79k	2058
17:24:31	236.5	13.11k	13.32k	2376
17:24:52>	222.6	13.16k	13.37k	2392
17:25:11*	222.3	12.63k	12.84k	2278
17:25:17<	237.5	12.45k	12.66k	2245
17:26:11	236.8	13.00k	13.20k	2380
17:27:11	237.9	13.10k	13.33k	2381
17:27:40>	222.6	13.11k	13.32k	2398
17:27:51*	222.4	12.78k	12.98k	2325
17:28:11*	222.5	12.29k	12.48k	2214
17:28:31*	222.7	11.78k	11.87k	2088
17:28:51*	223.3	11.47k	11.65k	2031
17:29:11*	223.1	11.49k	11.67k	2037
17:29:31*	224.2	11.53k	11.71k	2043
17:29:51*	223.3	11.57k	11.76k	2048
17:30:11*	224.2	11.60k	11.79k	2057
17:30:31*	223.2	11.60k	11.78k	2044
17:30:51*	223.9	11.60k	11.78k	2048
17:31:11*	224.8	11.59k	11.77k	2038
17:31:31*	224.1	11.60k	11.77k	2049

05-07-00	V-1N	W-Σ	VA-Σ	VAr-Σ
17:31:51*	224.8	10.66k	10.82k	1626
17:32:11*	224.5	9945	10.09k	638.5
17:32:31*	224.7	9850	9170	-538.5
17:32:51*	224.2	9135	9225	- 1289
17:33:11*	223.8	9115	9285	- 1283
17:33:30*	224.6	9115	9285	- 1278
17:33:50*	225.5	9125	9288	- 1278
17:33:58<	239.9	9135	9210	- 1277
17:34:50	238.0	10.21k	10.32k	- 1428
17:35:50	236.7	10.18k	10.28k	- 1418
17:36:27>	222.6	10.13k	10.23k	- 1413
17:36:30*	222.5	10.07k	10.16k	- 1405
17:36:50*	222.0	9620	9715	- 1354
17:37:10*	221.4	9230	9320	- 1303
17:37:30*	222.0	8870	8960	- 1258
17:37:50*	222.2	8870	8970	- 1260
17:38:10*	222.5	8895	8998	- 1264
17:38:30*	224.2	8930	9815	- 1271
17:38:50*	222.5	8965	9855	- 1277
17:39:10*	221.7	8965	9865	- 1278
17:39:30*	222.3	8945	9845	- 1276
17:39:50*	222.7	8930	9820	- 1270
17:40:10*	221.3	8935	9825	- 1265
17:40:30*	220.7	8910	8998	- 1255

Phase L 1 (V-1 N) voltage is in alarm state (minimum and/or maximum alarm)
< ---4 Parameters selected for print-out
V-1 N L 1 phase voltage
W-Σ Average three-phase active power
VA-Σ Average three-phase apparent power
VAr-Σ Average three-phase reactive power

< ---< V-1 N voltage comes back above minimum alarm value
< ---> V-1 N voltage passes minimum threshold again

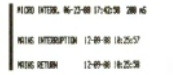
< ---* V-1 N voltage remains in minimum alarm state. The interval between two successive measures is now equal to the alarm interval.
< ---k The units of measurement are kW and kVA

Fig 2.4 TIMED LOCAL PRINT-OUT

< ---The minus sign indicates excess capacitive reactive power

PRINT-OUT OF A SECOND GROUP CF MEASUREMENTS FOLLOWS AFTER A TIME EQUAL TO 24 INTERVALS

Fig.2.5- PRINT-OUT OF POWER SUPPLY INTERRUPTIONS



Microinterruption 200mS followed by interruption of 36 Sec and return of power supply.

2.5 INTERRUPTIONS

An interruption is any break in the instrument power supply which is in no way related to the measurements being made. If the kind of monitoring is required for one of the phase on which measurements are being made. the instrument must be supplied by the circuit to which the voltage measurement cables are connected.
An interruption is a complete voltage failure (O Volts).
Interruptions in operation of any length are immediately recorded on the print-out.

Interruptions fall into one of three different categories:

MICRO-INTERRUPTIONS
Power supply failure lasting between 2.5 mSec and 1 sec.
A line such as that shown below is printed out. identifying the date. hour, minutes and seconds at which the micro-interruption occurred and its duration in mSec.

MIGRO INTERRUPTION DD:MM:YY HH:mm:ss xxxms

For interruptions lasting longer than one second, the instrument prints the date and hour of the beginning and end of the interruption.
The print-out is of the following type:

MAINS INTERRUPTION	DD:MM:YYHH:mm:ss
MAINS RETURN	DD:MM:YY HH:mm:ss

If switched off, the instrument prints the date and time when it is switched off and switched on again.

POWER OFF	DD:MM:YY HH:mm:ss
POWER ON	DD:MM:YY HH:mm:ss

In case of MICRO INTERRUPTIONS or MAINS INTERRUPTIONS the instrument continues to run on its battery until these are exhausted, at which point it switches off automatically.

Fig. 2.5 shows a print-out string for a short interruption in mains power supply. Note that power supply is returned by an initial rapid re- establishment of the switch contact (200 mSec) followed by a further re-establishment (36 Sec.)

2.6 PLOTTER

The instrument provides print-out in bar graph form of the measurements of two parameters selected among those available: the plotter mode cannot be used for maximum measurements and energy readings.
The instrument stores 24 measurements for each parameter at intervals preset by the operator (sampling time). At the end of the sampling period the two plotter graphs are printed one after the other.

The plotter zero and full scale values may be preset by the operator or established automatically by the instrument.
As shown in Fig.2.6 , the tape also shows the date, the parameter monitored in the graph, the hour when the readings were taken, the values of the 24 measurements in numbers, and the preset zero and full scale values.
If the parameter shown in the plotter graph has also passed one of the alarm thresholds, the data print-out also indicates the alarm value.

When interpreting plotter graphs, remember that the instrument may give negative measurements for some electrical parameters (- kW indicates active power supplied to the circuit; -Coø indicates leading power factor. etc.)
These parameters may be represented in a plotter graph as shown in Fig. 2.8, which shows the reactive power of a capacitor bank. This is first too low (+ KV Ar) , and is then in excess of the load circuit requirement (-KV Ar) in succeeding periods.

It should also be remembered that the forced print procedure already described in the timed print section can be used to obtain immediate print-out of a partial plotter graph (see Fig. 2.7).

The forced print procedure can also be used to synchronise the two plotter functions, which are generally programmed at different times and thus start at different times. This also occurs when the instrument is switched on, since the forced print procedure is carried out automatically.

2.7 ALARM SIGNALLING

The instrument is able to indicate (by print-out) whether a parameter has exceeded a maximum threshold preset by the operator (Maximum alarm).
In the same way. it is also able to indicate when a parameter passes below a minimum threshold preset by the operator (Minimum alarm).

DATE

Fig.2.8

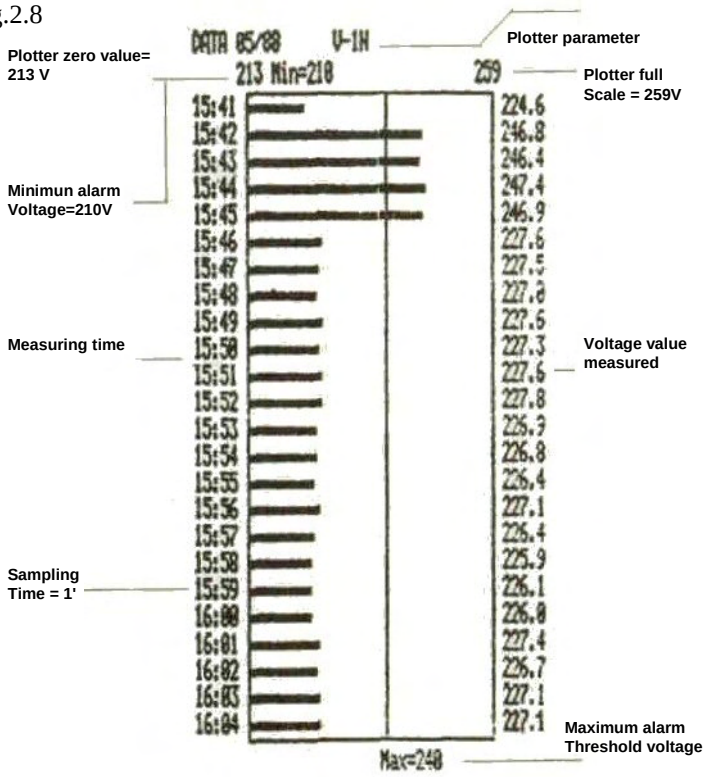


Fig.2.6 PLOTTER GRAPH FOR VOLTAGE OF PHASE L1 (R)

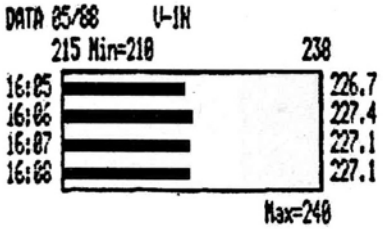


Fig.2.7 FORCED PLOTTER PRINT-OUT

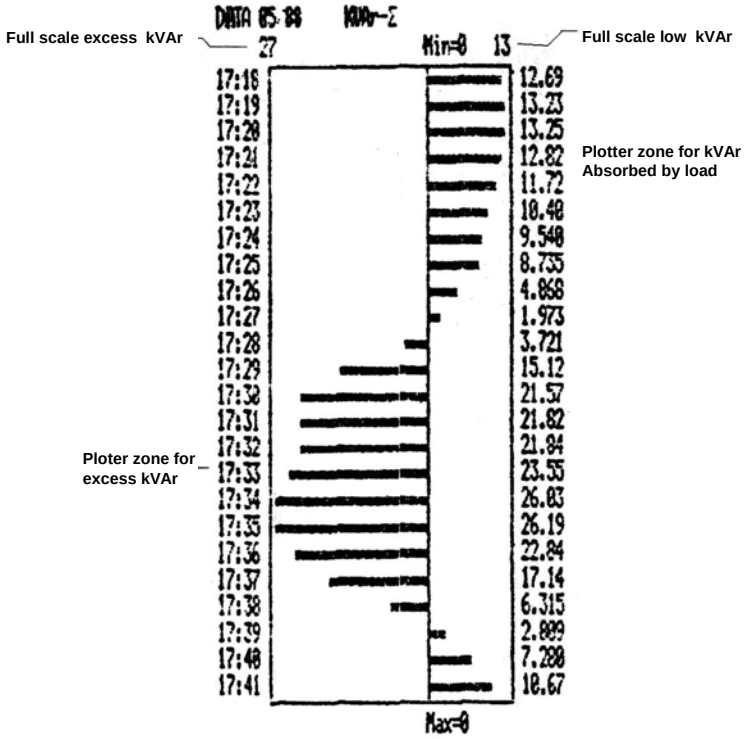


Fig.2.8 PLOTTER GRAPH OF EXCESS OR LOW THREE-PHASE REACTVE POWER

Alarm thresholds can be set for an unlimited number of the 49 parameters in the list below:

Instantaneous voltage = 3 ph.to ph. voltages + 3 ph.to neu. voltages
Instantaneous current = 3 phase currents + neutral currents
Instantaneous active power = kW of each phase + three phase kW
Instantaneous CoSø = Cosø of each phase + three phase Cosø
Average active power = kW of each phase + three phase kW
Instantaneous apparent power = kVA of each phase + three phase kVA
Average apparent power = kVA of each phase + three phase kVA
Instantaneous reactive power = kVAr of each phase + three phase kVAr
Average reactive power = kVAr of each phase + three phase kVAr
Instantaneous distortion = Distortions for 3 phases and three phase distortion
Average distortion = Distortions for 3 phases and three phase distortion
Frequency
Auxiliary parameters

The operator is informed that a parameter has passed a threshold value by an immediate alarm print. The instrument first prints the hour when the threshold was passed. followed by the hour when the parameter came back within the limit values, together with print-out of the maximum measurement (or minimum. if a minimum threshold is passed) during the period in which the parameter was beyond the threshold. To activate this function, the operator selects the parameters to be monitored and presets the maximum and minimum alarm measurements. The print-out shown in Fig. 2.9 refers to alarms for three phase active power (kW-∑). for phase L 1 voltage (V-1 N) and the three phase power factor (Cosø-∑).

Three phase active power is in alarm at values of > 50 kW; for phase L 1 voltage the maximum threshold is 240 Volts and the minimum 210 Volts. while the three phase Cosø minimum alarm threshold is 0.85.

< kw-∑ power passes max. alarm threshold
< L 1 phase voltage is >240 V; it therefore enters alarm state
< During the alarm max. V-1N was 253.8 V
< L 1 phase voltage falls below 240 V and therefore leaves the alarm state
< During the alarm max. kW-E was 57.39 kW
< The power value leaves the alarm state

During the period covered the third parameter monitored has never been in alarm state.

Fig. 2.9 ALARM PRINT -OUT FOR TWO PARAMETERS

The print-out shows that at 12:01: 14 hours the three phase active power reached a value of 54.70 kW and therefore passed the alarm threshold (as indicated by the symbol -->). At 12:01 :42 hours the power reading fell to 48.3 kW. returning within the preset limits (indicated by < ---). The peak power value during the interval between 12:01:42 hrs and 12:01: 18 hrs was 57.39 kW.

2.8 TIMED PRINT-OUT ALARMS

Alarms can also be signalled in timed local print-out mode. If a parameter which passes an alarm threshold is also selected for print-out, the data print-out will show a special symbol against the measurement.

If the operator has preset an alarm time (A.T.), which should be of small duration and shorter than the print-out time (PT.) a number of measurements may be printed during both the alarm periods and the timed print intervals.

Fig. 2.10 below is an example of various print intervals for a parameter set for both timed print-out and alarm monitoring.

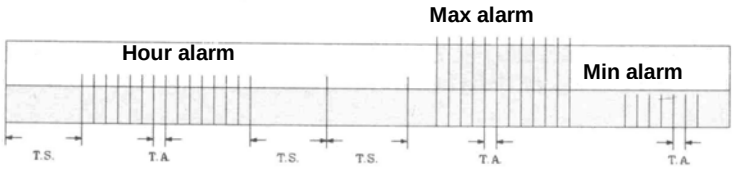


Fig. 2.10

2.9 TARIFF TIME BAND ALARMS

One of the special alarms which the instrument is capable of signalling is when power ratings are exceeded during the time interval when the load is largest, which are generally the most expensive for the consumer.

The VIP SYSTEM 3/ MK 3 can be preset to provide alarm print-out when one or more energy parameters (active, reactive or apparent power) exceed set maximum levels in each of the time intervals into which the day can be divided.

To activate this function, the operator must first set the times for the time intervals in which monitoring is required. He then selects the parameters to be monitored and the relative maximum threshold values.

2.10 RELAY ALARMS

Print-out of alarms. even if immediate. provides only retrospective monitoring. They permit the problem to be diagnosed and appropriate measures to be taken. but rapid signalling and intervention are not possible.

However, the VIP SYSTEM 3 / MK 3 are also fitted with two relay outputs for immediate alarm signalling: these are activated respectively when two of the selected parameters pass the alarm measurements.
The two parameters to be monitored are selected in the PERIPHERALS MENU, from the parameters which have already been selected for alarm monitoring: the alarm threshold values are those already preset.

The two relay outputs can be used far a wide range of different purposes: nearby or remote warning lights or acoustic signals, emergency intervention on the loads or plants etc.

2.11 PRESETTING PRINT-OUT

A number of operational presettings must be made before the instrument can be used to make measurements and print out the relative data.
These are quite often settings which do not require modification: the operator can therefore print all the preset values stored in the instrument and assess which data and conditions can be retained and which require alteration.

Alongside the presetting values, other settings and programming are required. These can also be printed out to allow the operator to check them through.
When presetting print-out is requested, the printer supplies a data print-out containing the set up values and those for all the presettings made.
Fig. 2.11 shows a print-out with all the SET-UP presettings .

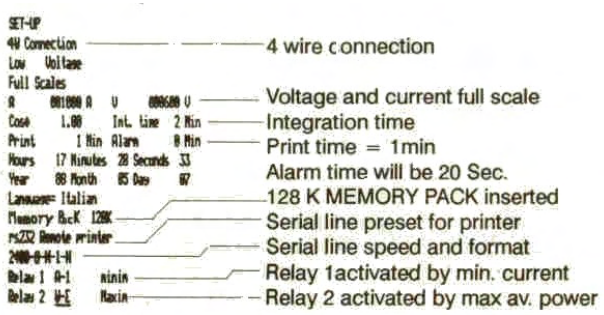

SET-UP
4W Connection
4 wire connection
Low Voltage
Full Scales
A 001000 A V 000600 V
Voltage and current full scale
Cosø 1.00 Int. time 2 Min
Integration time
Print 1 Min Alarm 0 Min
Print time = 1min
Hours 17 Minutes 28 Seconds 33
Alarm time will be 20 Sec.
Year 00 Month 05 Day 07
Language= Italian
128 K MEMORY PACK inserted
Memory Back 128K
Serial line preset for printer
rs232 Remote printer
Serial line speed and format
2400-8-N-1-N
Relay 1 A-I minin
Relay 1activated by min. current
Relay 2 W-Σ Maxin
Relay 2 activated by max av. power

Fig 2.11 SET-UP PRESETTINGS PRINT-OUT

SETUP PRESETTINGS

- Measuring connections (3 wires -4 wires)
- System voltage (Low Voltage -Medium Voltage)
- Current full scale (to be set only if a C.T. other than the clamp meter provided is used).
- Voltage full scale (to be set only for Medium Voltage readings).
- Cosø, to give the kVAr required for power factor correction.
- Integration time (for average values)
- Print time (between 1 and 99 minutes)
- Alarm print time (if a print interval shorter than that set for the timed print-out is required during alarm states).
- time : hours xx minutes xx seconds xx
- date: year xx month xx days
- 128k Memory pack (if inserted) Black Box (if inserted)
- RS232; Presence of Remote printer and Host computer
- Relay 1 : parameter being monitored; Type of alarm (min/max)
- Relay 2: parameter being monitored; Type of alarm (min/max)

2.12 PRINT-OUT OF LOCAL PRINTER PRESETTINGS

Two presettings are required before the timed local print-out mode can be used (normal print interval and alarm print interval). These are included in the SET UP presettings.
The 4 parameters to be monitored through the print-out (3 parameters only if energy parameters are selected) must also be set.

In the same way. the PLOTTER print mode requires setting of the sampling time (i.e. the time interval between two readings indicated on the graph). and the parameter to be monitored. The relative procedures will be described in full in chapter 3 below. which will also examine the procedure for obtaining print-out of all local printer presettings. Fig. 2.12 shows an example of a print-out with data relative to the timed local print-out mode and the two plotters.

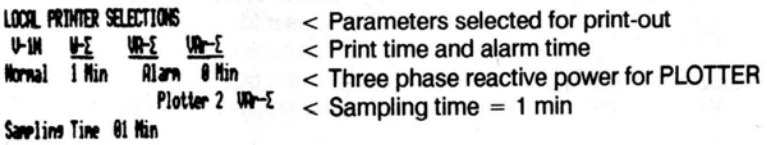

LOCAL PRINTER SELECTIONS
< Parameters selected for print-out
V-LN W-Σ VAR-Σ VAr-Σ
< Print time and alarm time
Normal 1 Min Alarm 0 Min
< Three phase reactive power for PLOTTER
Plotter 2 VAr-Σ
< Sampling time = 1 min
Sampling Time 01 Min

Fig. 2.12 DATA SELECTED FOR LOCAL PRINT-OUT

2.13 PRINT-OUT OF ALARM PRESETTING

To activate the alarm print-out function. the parameters for monitoring must be selected and the minimum and maximum alarm thresholds set.
The alarm sensitivity. or the time for which a parameter may remain above or below a threshold value before the alarm state is recorded on the print-out. must also be set: chapter 3 will explain the selection and setting procedures.

As for the other selections and presettings, these values can be printed out to allow the operator to check that the instrument is correctly programmed. Fig.2.13 shows a print-out with alarm presettings relative to 3 parameters: this is interpreted as follows:

1 st line Monitored parameter V-1 N = L 1 phase voltage
Minimum alarm value 210 Volts
Maximum alarm value 240 Volts

2nd line Monitored parameter W-Σ= three-phase active power 50kW
Minimum alarm value

3rd line Monitored parameter Three phase Cosø

Last line A/arm sensitivity for all the above alarms.

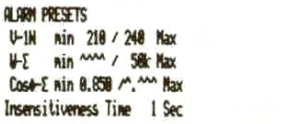


Fig. 2.13 ALARM SELECTIONS AND PRESETTINGS

2.14 USE OF THE VIP SYSTEM3 WITH PERUIPHERALS

The number of functions offered by the VIP SYSTEM 3 / MK 3 can be considerably increased by the use of peripherals such as an external printer, a Host Computer, and signalling or intervention relays.

A remote printer can provide timed print-out of data relative to 7 -13 parameters selected using a procedure which starts from the peripherals menu.

(To be more specific, an 80-column printer can give print-out of 7 parameters in normal print and 13 in condensed print mode, while a 132-column printer can provide print-out of 13 parameters in normal print mode.

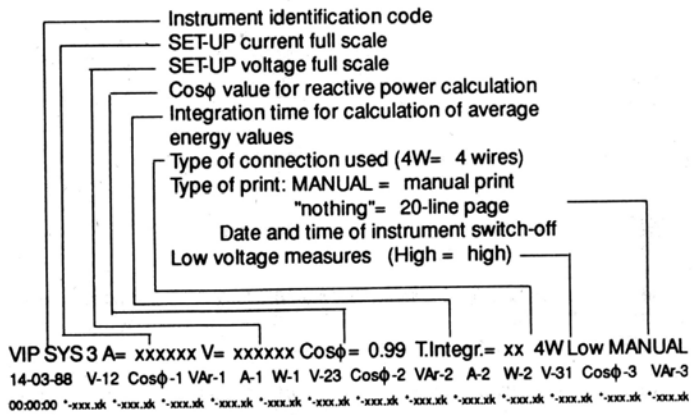
This represents a considerable increase in the number of parameters which can be monitored while the system is in operation.

Let's take a detailed look al all the functions which can be carried out using an external printer:

- Timed print-out of 7-13 parameters. The data print is preceded by a heading line with all the SET UP values, and a line with the symbols of the parameters being monitored.
At the end of the sampling time (equal to the print time preset during the SET UP phase), a line of measurement data is immediately printed. The two heading lines are repeated after every 20 data lines.
Fig. 2.14 shows an example of timed print-out with compressed characters.

- Manual print-out
The operator gives the instruction for print-out of a line with the latest measurements relative to the selected parameters; (i.e. the print-out consists of the two heading lines and one data line, as shown in the example below.

Example of manual print-out


Instrument identification code
SET-UP current full scale
SET-UP voltage full scale
Cosϕ value for reactive power calculation
Integration time for calculation of average energy values
Type of connection used (4W= 4 wires)
Type of print: MANUAL = manual print
"nothing"= 20-line page
Date and time of instrument switch-off
Low voltage measures (High = high)
VIP SYS 3 A= xxxxxx V= xxxxxx Cosϕ= 0.99 T.Integr.= xx 4W Low MANUAL
14-03-88 V-12 Cosϕ-1 VAr-1 A-1 W-1 V-23 Cosϕ-2 VAr-2 A-2 W-2 V-31 Cosϕ-3 VAr-3
00:00:00 *-xxx.xk *-xxx.xk *-xxx.xk *-xxx.xk *-xxx.xk *-xxx.xk *-xxx.xk *-xxx.xk *-xxx.xk *-xxx.xk *-xxx.xk *-xxx.xk *-xxx.xk

After the manual print-out the timed print procedure is reinitialised

Alarm print -out

The timed print-out mode also includes print signalling when any alarm thresholds set in either the alarm menu or the timed print mode are passed (see fig.2.15)

VIP SYS.3 A=001000 V=000600 Cosϕ=1.00 T.Integr.= 2 4W Low MANUAL

07-05-88	Hertz	V-12	V-23	V-31	A-1	A-2	A-3	A-N	#V-Σ	#Cosϕ-Σ	VAr-Σ	VA-Σ	%-Σ
15:34:19	49.9	379.4	367.6	378.6	73.4	68.7	68.8	6.28	44.63k	0.976	9.92k	45.72k	0.00
15:35:16	49.9	380.7	369.0	379.9	73.7	69.0	69.0	6.31	44.95k	0.976	10.04k	46.06k	0.01
15:36:14	49.9	379.2	367.4	378.3	73.3	68.7	68.8	7.91	44.56k	0.975	10.05k	45.68k	0.00
15:37:12	49.9	378.1	366.6	377.6	73.2	68.6	68.6	10.05	44.34k	0.975	10.13k	45.48k	0.00
15:38:09	49.9	378.3	366.4	377.4	73.1	68.5	68.6	10.16	44.28k	0.975	10.15k	45.43k	0.00
15:39:07	49.9	377.2	365.9	376.6	73.0	68.4	68.5	7.19	44.18k	0.976	9.83k	45.26k	0.01
15:40:05	49.9	378.2	366.4	377.4	73.1	68.5	68.5	8.47	44.31k	0.976	9.89k	45.40k	0.01
15:41:03	49.9	378.0	366.6	377.2	73.1	68.5	68.5	6.53	44.31k	0.976	9.88k	45.40k	0.01
15:42:01	50.0	378.2	366.5	377.4	73.1	68.5	68.5	6.32	44.34k	0.976	9.80k	45.41k	0.00
15:42:25	49.9	408.6	395.9	408.0	79.8	74.7	74.7	9.27	› 52.17k	0.975	11.98k	53.53k	0.01
15:42:43	49.9	415.6	402.9	414.7	81.2	76.0	76.0	5.80	* 54.03k	0.975	12.20k	55.39k	0.00
15:43:02	49.9	415.5	402.8	414.7	81.1	76.0	76.1	10.13	* 53.93k	0.974	12.59k	55.38k	0.00
15:43:22	49.9	415.6	402.8	414.8	81.0	75.9	76.0	8.50	* 53.92k	0.975	12.32k	55.31k	0.01
15:43:41	49.9	415.1	402.4	414.5	80.8	75.8	75.8	9.74	* 53.70k	0.974	12.55k	55.15k	0.00
15:44:00	49.9	415.2	402.5	414.4	80.8	75.7	75.8	7.36	* 53.77k	0.975	12.17k	55.13k	0.00
15:44:20	49.9	416.0	403.1	415.1	80.9	75.8	75.9	7.84	* 53.90k	0.975	12.27k	55.28k	0.01
15:44:39	49.9	416.3	403.4	415.4	81.0	75.9	75.9	9.93	* 53.93k	0.974	12.57k	55.38k	0.00
15:44:58	49.9	415.6	403.3	415.1	80.7	76.0	75.7	9.94	* 53.83k	0.974	12.40k	55.24k	0.00
15:45:17	49.8	416.5	403.6	415.5	80.9	75.9	75.8	11.32	* 53.89k	0.973	12.67k	55.36k	0.00
15:45:37	49.8	416.2	403.4	415.5	80.8	75.8	75.9	7.47	* 53.94k	0.975	12.19k	55.30k	0.00

VIP SYS.3 A=001000 V=000600 Cosϕ=1.00 T.Integr.= 2 4W Low

07-05-88	Hertz	V-12	V-23	V-31	A-1	A-2	A-3	A-N	#V-Σ	#Cosϕ-Σ	VAr-Σ	VA-Σ	%-Σ
15:45:56	49.9	416.2	403.4	415.3	80.8	75.7	75.8	7.02	* 53.89k	0.975	12.23k	55.26k	0.00
15:46:15	49.9	415.8	402.9	415.1	80.6	75.5	75.6	5.64	* 53.72k	0.976	12.03k	55.05k	0.00
15:46:34	49.9	416.3	403.2	415.2	80.7	75.7	75.7	8.99	* 53.81k	0.975	12.30k	55.20k	0.01
15:46:54	49.9	383.4	371.8	382.7	73.6	69.0	69.2	5.35	‹ 45.32k	0.977	10.00k	46.41k	0.00
15:46:55	49.9	383.6	372.0	382.8	73.7	69.1	69.2	6.85	45.37k	0.976	10.10k	46.48k	0.00
15:47:53	49.9	382.7	371.0	382.0	73.6	69.0	69.1	8.66	45.14k	0.975	10.28k	46.30k	0.00
15:48:50	49.9	382.4	370.4	381.6	73.7	69.0	69.1	5.85	45.18k	0.976	10.03k	46.28k	0.00
15:49:48	49.9	383.7	371.7	382.8	74.0	69.3	69.5	8.89	45.50k	0.975	10.30k	46.65k	0.00
15:50:46	49.9	382.9	371.1	382.3	73.9	69.2	69.3	9.51	45.31k	0.975	10.36k	46.48k	0.00
15:51:44	49.9	380.8	368.8	380.1	73.5	68.9	69.0	9.35	44.83k	0.975	10.26k	45.99k	0.00
15:52:42	49.9	383.4	371.9	382.8	74.1	69.4	69.5	10.69	45.48k	0.974	10.54k	46.69k	0.00
15:53:39	49.9	382.8	371.0	381.6	73.9	69.4	69.4	7.43	45.39k	0.976	10.14k	46.51k	0.01
15:54:37	49.9	382.5	370.8	381.8	73.9	69.3	69.2	8.92	45.28k	0.975	10.27k	46.43k	0.00
15:55:35	49.9	381.7	370.1	380.9	73.7	69.1	69.2	5.05	45.16k	0.977	9.93k	46.24k	0.01
15:56:33	49.9	382.0	370.1	381.2	73.8	68.9	69.3	8.80	45.12k	0.975	10.24k	46.27k	0.00
15:57:31	49.9	382.0	370.5	381.5	73.9	69.2	69.1	5.06	45.27k	0.977	9.90k	46.34k	0.00
15:58:28	49.9	381.1	369.4	380.3	73.6	68.9	69.0	5.49	44.98k	0.977	9.91k	46.06k	0.00
15:59:26	49.9	381.1	369.3	380.4	73.7	69.0	69.1	5.95	45.03k	0.976	10.01k	46.13k	0.00
16:00:24	49.9	380.8	368.9	380.1	73.6	68.9	68.9	6.46	44.91k	0.976	9.95k	46.00k	0.00
16:01:22	49.9	380.8	368.6	379.7	73.5	68.8	69.1	11.00	44.75k	0.974	10.48k	45.96k	0.00

Fig. 2.14

VIP SYS.3 A=001000 V=000600 Cosϕ=1.00 T.Integr.= 2 4W Low MANUAL

07-05-88	#V-1N	V-2N	V-3N	A-1	A-2	A-3	kWh-Σ
17:16:58	227.3	214.5	213.8	74.0	69.3	69.4	314.8790
17:17:54	› 242.7	228.7	227.9	79.5	74.4	74.5	315.5540
17:18:12	* 246.8	233.2	232.2	81.0	76.0	76.0	315.8231
17:18:31	* 246.7	233.0	232.1	81.0	75.8	76.0	316.0910
17:18:51	* 246.6	233.1	232.1	80.9	75.8	75.8	316.3580
17:19:10	* 246.6	232.9	232.0	80.8	75.8	75.8	316.6253
17:19:29	* 246.9	232.9	231.9	80.8	75.7	75.8	316.8922
17:19:48	* 246.7	233.0	231.9	80.7	75.7	75.8	317.1591
17:20:08	* 247.9	233.9	233.2	81.1	76.0	76.1	317.4275
17:20:27	* 248.1	234.4	233.3	81.1	76.0	76.1	317.6984
17:20:46	* 247.0	233.1	232.2	80.7	75.6	75.6	317.9661
17:21:06	* 246.9	233.6	232.9	80.9	75.8	75.9	318.2333
17:21:25	* 247.9	234.0	232.8	80.9	75.9	76.0	318.5035
17:21:44	* 249.4	235.2	234.4	81.4	76.4	76.4	318.7736
17:22:03	* 236.8	222.8	220.7	76.8	71.8	71.4	319.0461
17:22:07	‹ 222.7	210.4	209.4	71.8	67.4	67.5	319.0703
17:22:14	› 209.2	197.4	196.9	67.1	62.9	63.1	319.1363
17:22:21	‹ 228.4	215.5	214.9	73.8	69.3	69.4	319.2107
17:23:18	228.9	216.1	215.0	74.2	69.5	69.5	319.9202
17:24:16	213.4	201.3	200.7	68.9	64.6	64.6	320.5627

VIP SYS.3 A=001000 V=000600 Cosϕ=1.00 T.Integr.= 2 4W Low

07-05-88	#V-1N	V-2N	V-3N	A-1	A-2	A-3	kWh-Σ
17:25:14	213.0	201.1	200.2	68.9	64.6	64.6	321.1740
17:25:27	› 203.3	191.0	189.9	65.5	61.1	61.0	321.2937
17:25:45	* 193.5	182.6	182.0	62.2	58.2	58.3	321.4327
17:26:05	* 193.7	182.9	182.4	62.4	58.5	58.5	321.5720
17:26:24	* 194.1	183.3	182.6	62.6	58.5	58.6	321.7114
17:26:43	* 194.1	183.3	182.5	49.03	46.30	46.45	321.8311
17:27:03	* 193.4	182.4	182.0	48.86	46.14	46.31	321.9493
17:27:22	* 193.5	182.7	181.9	48.97	46.23	46.38	322.0627
17:27:41	* 193.5	182.5	182.0	48.98	46.24	46.40	322.1824
17:28:00	* 193.3	182.2	181.7	48.97	46.20	46.41	322.2958
17:28:20	* 193.4	182.4	181.4	49.01	46.25	46.32	322.4153
17:28:39	* 193.4	182.6	181.9	49.04	46.27	46.44	322.5203
17:28:58	* 193.6	182.6	181.8	54.8	46.31	46.45	322.6402
17:29:18	* 193.8	182.9	182.3	60.6	56.4	57.1	322.7630
17:29:37	* 193.7	182.8	182.2	60.6	56.4	57.1	322.8982
17:29:56	‹ 216.9	204.5	203.8	67.7	63.2	63.9	323.0427
17:30:15	216.8	204.7	203.8	67.8	63.0	63.8	323.1901
17:31:12	217.6	205.1	204.3	67.7	63.3	64.0	323.6605
17:32:10	217.9	205.4	204.5	67.8	63.2	64.0	324.1332
17:33:08	217.7	205.3	204.6	67.7	63.2	64.0	324.6106

Fig. 2.15

Alarm states are indicated on the print-out page as follows:

beside the symbol of the parameter set far alarm monitoring

> beside the reading when the parameter passes the threshold

< beside the reading when the parameter returns within the acceptable limits

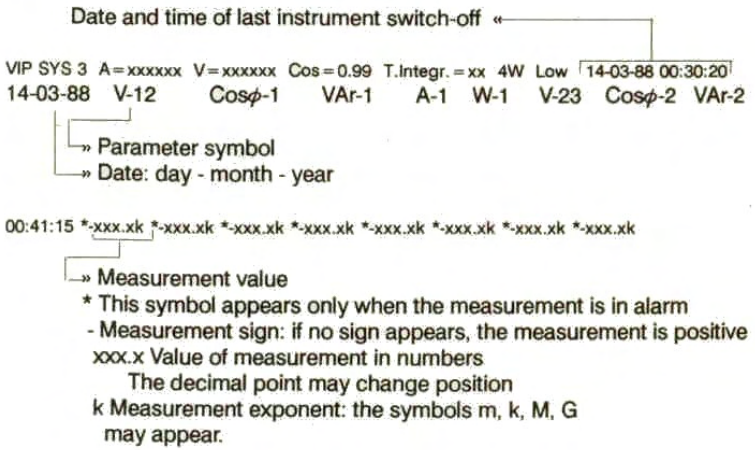
* beside parameter measurements which remain beyond the alarm thresholds.

During alarms, the print-out interval is changed to the one set as alarm interval in the SET UP phase. The timed print-out mode also records and marks alarm states relating to any time intervals programmed. If any programmed alarm threshold is passed, a line of data is immediately printed. During any hour alarm periods (set by the operator) the print-out interval remains the same as the alarm print interval preset during the SET UP phase.

Switch-offs

The external printer also signals any instrument switch-offs : the time when the interruption occurs is indicated at the end of the first heading line.
(Power failures are not recorded).

Example of print-out after instrument switch-off


Date and time of last instrument switch-off «
VIP SYS 3 A=xxxxxx V=xxxxxx Cos=0.99 T.Integr.=xx 4W Low 14-03-88 00:30:20
14-03-88 V-12 Cosφ-1 VAr-1 A-1 W-1 V-23 Cosφ-2 VAr-2
» Parameter symbol
» Date: day - month - year
00:41:15 *-xxx.xk *-xxx.xk *-xxx.xk *-xxx.xk *-xxx.xk *-xxx.xk *-xxx.xk *-xxx.xk
» Measurement value
* This symbol appears only when the measurement is in alarm
- Measurement sign: if no sign appears, the measurement is positive
xxx.x Value of measurement in numbers
The decimal point may change position
k Measurement exponent: the symbols m, k, M, G
may appear.

The activities of the external printer do not interfere with the normal operation of the local printer. meaning that the instrument can continue to carry out ali the functions already listed without remote printer: display of measurement data; manual print-out of display data; timed local print-out and plotter graph print-out; alarm print-out; time interval alarms; interruptions etc:

A serial printer can be connected directly to the instrument by means of an RS 232 serial line.
To make this connection, the operator must enter the printer specifications in the instrument and select the serial line speed and format.
As already seen, the print-out interval and alarm print-out interval are the same as for the local printer; i.e. those set during the SET UP phase.

The parameters are selected by means of a different procedure (using the peripherals menu), which is explained in paragraph 3.7 below.

Presetting and selection data can be printed out on the local printer; the table shows an example of presetting and selection for the remote printer; as shown. the parameters to be printed are the following:

L 1 phase voltage (V-1 N)
L2 phase voltage (V-2N)
L3 phase voltage (V-3N)
L 1 phase current (A-1)
L2 phase current (A-2)
L3 phase current (A-3)

Three-phase active energy consumption (kWh-Σ;)
The print-out also indicates the instrument presettings relating to the remote printer connected.

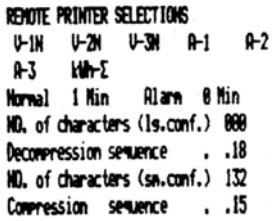

REMOTE PRINTER SELECTIONS
V-1N V-2N V-3N A-1 A-2
A-3 kWh-Σ
Normal 1 Min Alarm 0 Min
NO. of characters (1s.conf.) 000
Decompression sequence . .18
NO. of characters (sa.conf.) 132
Compression sequence . .15

Fig. 2.16 PRINT-OUT SHOWING REMOTE PRINTER SELECTIONS AND PRESETTINGS.

2.15 USE OF INSTRUMENT WITH HOST COMPUTER

The operating options which can be obtained by combining the VIP SYS 3/ MK 3 with a host computer offer extremely interesting possibilities.
All measurements taken and processed by the instrument can be stored in the host computer, and can also be transfered to and stored on magnetic discs. The instrument is connected to the host computer, as to the remote printer, by ~ means of an RS232 serial line .
A special transmission protocol inside the instrument allows most operational ..functions to be transmitted to the computer. For further information regarding this protocol, contact the ELCONTROL offices to request the technical manual.
The only differences between the operational possibilities obtainable with the host computer with the VIP SYSTEM 3 and the VIP MK3 concern the MEMORY PACK and the BLACK BOXES, which are not available on the VIP MK3.
ELCONTROL are able to supply programs to allow the instrument to be connected to IBM or compatible .personal computers. The program allows call-up of measurement data, remote programming, transfer of MEMORY PACK data (VIP SYSTEM 3 only) and management of the data archive.
The data can also be processed for special applications using standard programs such as LOTUS, FRAMEWORK, EXCEL, DBASE etc.
Further details are available in the specific documentation on this subject.

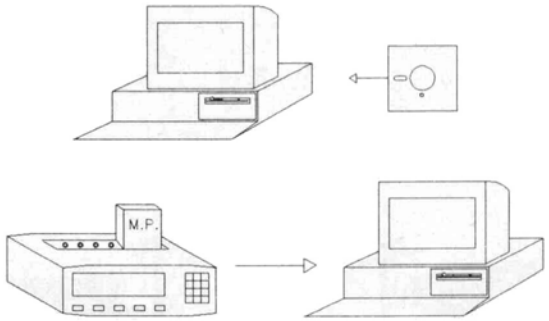


Fig. 2.17

2.16 MODEM CONNECTION FOR REMOTE MONITORING

The instrument can be connected to the telephone lines (public or internal circuits) using the Modem system, to allow remote reading of the data obtained. Connection by means of a dedicated telephone line can be considered as similar to a direct RS232 serial connection, except for the control signals typical of control of a Modem line but requires a fixed line 24 hours a day.

Connection by means of a public or switched line requires a simple telephone line to which the Modem can be connected. In this case, apart from the Modem connection costs, the user pays only for the time in which the connection is active.

With the latter type of connection the difference between the VIP MK3 and the VIP SYSTEM 3 becomes very clear.

With the VIP MK3 the user can only transfer current measurements and counter values, while with the VIP SYSTEM 3 and the MEMORY PACK the operator can store an entire day's data and transfer them during the night when telephone costs are lower.

Fig. 2.18

Fig. 2.19

2.17 USE OF THE MEMORY PACK FOR SURVEYS (SYSTEM 3 ONLY)

The MEMORY PACK is a mass memory comprising a battery RAM CMOS on which all measures made by the instrument at a preset interval are stored.

Each of this storage procedures is known as a "record", and consists of a "photograph" of ALL the measurements, including average power values, counter values, power failures and microinterruptions .

The MEMORY PACK is generally used for measuring surveys, where a "survey" is a period of time during which all the instrument's readings are recorded at fixed time intervals (rates).

Two MEMORY PACKs of different capacities can be used: the smaller is of 128 K, while the larger offers 512 K. The 128K MEMORY PACK is capable of storing 14 surveys and more than 649 records.

A survey is programmed by entering exact indications of the begin and end times and sampling rate.
The MEMORY PACK may be programmed with a sequence of surveys to be carried out automatically, provided they all refer to measures regarding the same point in the system.
The chart below shows an example of 4 automatic surveys: as will be noticed, the only difference between the 4 surveys is the different sampling rate in the four different energy tariff bands.

PROGRAMMING EXAMPLE FOR 4 SURVEYS

Survey N.1	Start End Interval	88.2.13 88.2.15	7h 30 min. 7h 30 min. 60 min.	Measurements for weekend period
Survey N.2	Start End Interval	88.2.15 88.2.15	7h 30 min. 8h 30 min. 2 min.	Measurements for startup phase
Survey N.3	Start End Interval	88.2.15 88.2.15	8h 30 min. 12h 30 min. 10 min.	Measurements for user peak period.
Survey N.4	Start End Interval	88.2.16 88.2.16	8h 30 min. 17h 30 min. 15 min.	Measurements for a working day.

If automatic measuring surveys are programmed with different time intervals the 128K MEMORY PACK is capable of storing data for an entire week (e.g. sampling every 10 minutes for 10 hours followed by sampling every 30 minutes for the remaining 14 hours gives a total of 616 records in 7 days) .

The various surveys are generally not all related to the same load system as is the case in the example above.
For example, surveys can be programmed for different groups of loads within a user system (see Fig. 2.20), or for different users.
In situations of this kind. the Memory pack is used to carry out manual surveys. using the SET Up presettings with which the instrument has been programmed and changing the connections for each survey.

The survey starts as soon as the measuring rate has been set and tinishes when the operator ends the procedure.

In automatic surveys, the operator can program all the surveys he requires or which the MEMORY PACK can take off-site: ON SITE he simply connects the instrument before starting the first survey and removes the instrument and MEMORY PACK when the final survey is complete.

During manual surveys the operator must be present on site to make the presettings and to start the survey: he must return on site at the time when he wishes to end the survey and perhaps start another.

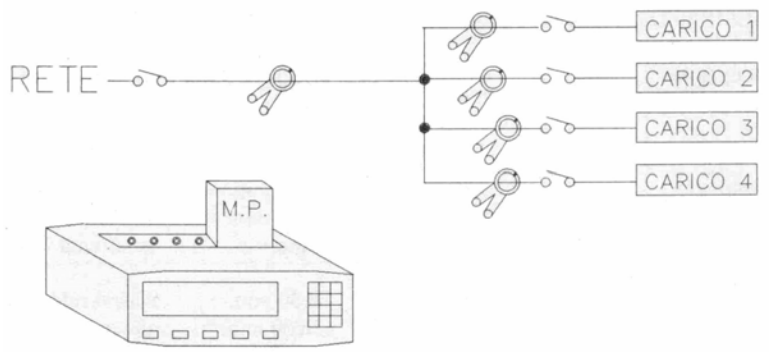


Fig. 2.20 EXAMPLE OF 5 **SURVEYS WITH MEASUREMENTS TAKEN AT DIFFERENT POINTS IN** A **SYSTEM.**

2.18 SURVEY DATA PRINT-OUT

At the end of a survey, the data stored on the Memory pack is transferred back into the instrument, which has previously been programmed to select some of the data received.
From the instrument, the selected data is then transmitted to the external *f* printer along the RS232 serial line. If an 80 column external printer is used, up ,t to 8 parameters can be selected for printing, while 132-column printers can take up to 13 parameters (spaced print).
Together with these measurements, the Memory pack also stores and transmits to the printer all interruptions and micro- interruptions in its power supply.
Even after transferring the survey data, the Memory pack continues to store these measures, meaning that the data relating to different parameters collected during the same survey can later be transmitted: for example, the measurements for a second group of 8/13 parameters can be printed out.
At the end of the survey, the operator (if he wishes) can request print-out of measurements for all the parameters stored on the Memory pack, up to a maximum of 64 parameters.
The advantage of using survey operation, apart from the availability of a large amount of data, is that the operator can program the Memory pack off-site.
The instrument can then be connected to the circuit by staff unskilled in the use and programming of the VIP SYSTEM 3.
At the end of the survey the instrument and Memory pack are removed and those measures which the operator wishes to check and analyse are printed out off-line.
While the survey is in progress, the VIP SYSTEM 3 can function as if the Memory pack were not connected.
This means, for example, that the operator can still read the measurements for the monitored parameters on the display and obtain manual print-out of the data.
He can also program timed local print-out for a maximum of 4 parameters, request plotter print-out of 2 parameters, program alarm state print-out of any parameter and request excess energy consumption for the various time bands.
At the end of the survey the operator will have at his disposal sufficient data / and information (instrument measurements and survey data) for sophisticated analysis of the electrical system being monitored.

2.19 PYROMETER; BLACK BOX FOR TEMPERATURE MEASUREMENT (VIP SYSTEM 3 only)

A special compartment on the instrument can be fitted with a Black Box. which is a specially programmed interface allowing the measurement of other parameters in addition to the electrical parameters typical of an industrial user system.
The instrument's range of functions can therefore be expanded to include measurement of any additional parameters for which the relative Black Box and, naturally. measurement transducer are available.
This means that all the operational modes (display, print-out. Plotter graph print-out). alarm state monitoring (with print-out or relay signalling). and the survey monitoring options, can be applied to any of the additional parameters.
The standard electrical measurements and the new measurements can be taken simultaneously.

This opens the instrument up towards a range of new applications, which ELCONTROL intend to develop further in the near future.

At present, ELCONTROL have prepared the first Black Box for use with the instrument, which measures the temperature of an object in the range from -20°C to + 200°C (-4°F to + 424°F) using a special pyrometer.
The pyrometer is an infrared gun which measures the heat radiation emitted by the body and transducers this intensity into a weak signal.
The signal is then amplified and transmitted to the instrument by connection to the rear AUX connector.
The Pyrometer Black Box contains a program which enables the instrument to display and print the pyrometer's temperature measurements.

The temperature is displayed only in degrees Centigrade.

The temperature measurements obtained with the pyrometer Black Box can serve two main purposes:

-Identification of hot spots:
In this case the zone under examination is scanned directly, checking the temperatures of the various points on the display.
When the pyrometer identifies a point with higher temperature the instrument provides a BEEP signal in addition to the display reading (see Fig: 2.21) .

-Precision checking of temperature in points of the plant (or the equipment) of special interest.

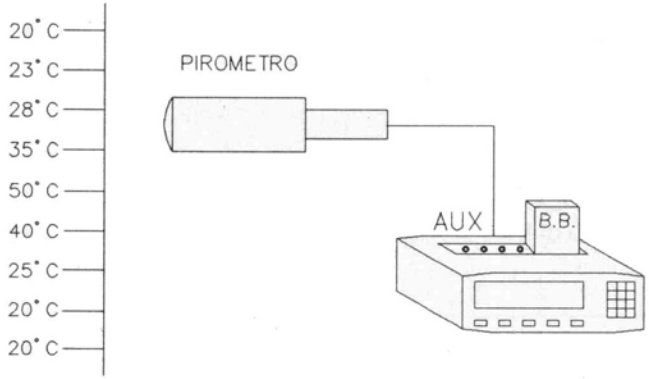


Fig. 2.21

For this function the pyrometer is first positioned at a distance of 20-25 cm (depending on the size of the body for monitoring). The pyrometer must then be regulated as appropriate for the type of material and the surface area of the heat-producing body.

2.20 LEAKAGE CURRENT

The leakage current measurement (shown on the display and in print-out with the symbol LmA) permits clear identification of any points where the insulation is no longer efficient because of deterioration or contamination of the insulating material.

This is an auxiliary function of the VIP SYSTEM 3. requiring a suitably programmed Black box and the special leakage toroid, which must be connected to the instrument as shown in the fig. 2.21: the toroid cable is connected to the AUX connector on the rear of the instrument. while the Black box is fitted in the compartment provided. In the VIP MK3 the program for leakage current monitoring is resident in the instrument and the toroid is simply connected to the AUX connector by means of the special interface.

The VIP SVSTEM 3/MK 3 can provide LmA monitoring in all the following modes:

Display indication (page 16). Manual print-out (page or overall) Timed local print-out. Plotter print-out.
Alarm state print-out.
Using a remote printer. With survey.
With activation of alarm relays.

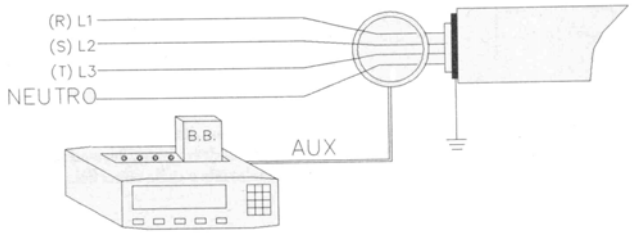


Fig. 2.22

Fig.2.22

The toroid is connected at the point of the plant to be monitored so that all the phase wires plus neutral pass through it.

3 USE OF THE VIP SVSTEM 3 and MK3

3.1 PRELMINARY PROCEDURES

The VIP SYSTEM 3 and VIP MK3 can be used far the following functions:

1 -Display indication of all electrical and auxiliary measurements.
2 -Print-out of measurements in various modes (manual print-out. timed print-out or plotter graph print-out).
3 -Alarm print-out. activation of alarm relays.
4 -Use with peripheral units (remote printer or host computer.)
5- Storage of survey data on MEMORY PACK (SYSTEM 3 only).

The functions listed above are activated by different procedures, but the preliminary operations below are required for all functions:

-Connection of instrument power supply.
-Connection to the circuit to be monitored.
-Initial presettings procedures.

3.1 1 Instrument power supply .

As has already been described in paragraph 1.8. the instrument can be powered by the power supply (mains) or by a standby battery.

Remember that the battery charge will be sufficient for about 3 hours' operation without print-out or illumination of the display.
The battery should therefore not be used when the instrument is functioning unattended or during lengthy print-out sequences.

The battery will recharge in about 48 hours if the instrument is run from the mains power supply. or can be rapidly recharged (about one hour) using the special FBC1 accessory connected to the power supply (mains) and to the connector on the rear of the instrument (see Fig. 3.1).

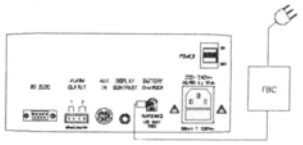


Fig. 3.1

3.1.2 CONNECTION TO CIRCUIT.

The upper part of the instrument houses a series of safety connectors for the voltage and current connections.

The instructions which follow must be complied with; otherwise measurement errors will occur.

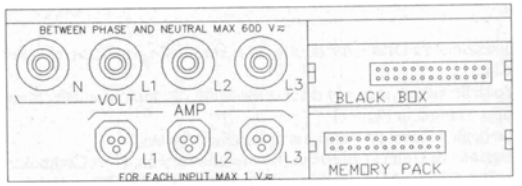


Fig. 3.2

Fig 3.2

VOLTAGE MEASUREMENT CONNECTIONS

The voltage measurement connection is made using the leads provided, following the diagrams in figs. 3.3.1 and 3.3.2.

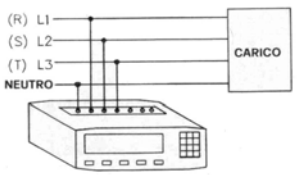


Fig 3.3.1

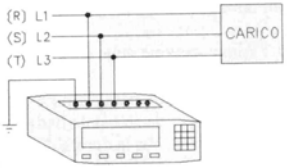


Fig 3.3.2

Always check that phase rotation direction is respected when making the connections.

The instrument checks this automatically on display page 5. where the following messages are displayed:

PHASE ROTATION OK = **Connection correct**
PHASE ROTATION NOK = **Connection incorrect**

N.B. When connecting to circuits with voltage levels exceeding 250 V (neutral phase) or with high DC currents, probes and test prods suitable for the measuring point should be used. These are available as optional accessories.

4-WIRE SYSTEM (THREE PHASES PLUS NEUTRAL)

The connections are made as shown in figure 3.4.
When making the connection it is vital to check that **each clamp meter 15 connected to the same phase of the corresponding voltage measurement.**
A connection error will have significant effects. since an angle of 120 degrees will be added to the phase shift angle between current and voltage.
The clamp meter can be connected without reference to current direction, since the instrument itself will invert this if incorrect.

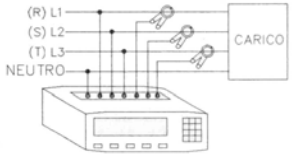


Fig 3.4

Program the set-up as explained in paragraph 3.1.7, selecting "4- WIRE" connection.

3-WIRE- SYSTEM (WITHOUT NEUTRAL)

Make the connections as shown in figure 3.5.
When making the connection it is vital to check that each clamp meter is connected to the same phase of the corresponding voltage measurement. A connection error will have significant effects. since an angle of 120 degrees will be added to the phase shift angle between current and voltage.
The clamp meter can be connected without reference to current direction, since the instrument itself will invert this if incorrect.
Connect the instrument neutral to the system earth (ground).

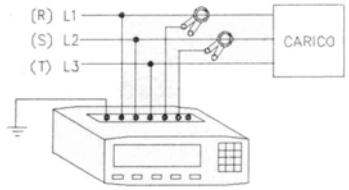


Fig. 3.5

Program setup as explained in paragraph 3.1.7 , selecting "3- WIRE" connec tion.
N.B.: A connection with 3 clamp meters as shown in figure 3.4 can also be made in a 3-wire system without neutral.

In this case proceed as follows:

-Program "4-WIRES" in the set-up phase

-Connect the neutral to earth (ground)

A low neutral current reading will however be provided, caused by inevitable small imbalances in the system.

3.1.3 SPECIFIC CONNECTIONS

C.T. OR CLAMP METERS OTHER THAN STANDARD

If using a C.T. (current transformer) or measuring clamps other than the clamp metres provided, the speciallNTA/1 or INTA/5 interfaces, available as optional accessories, must be used.

1) Connect the C.T. secondary winding to the INTA/5 or INTA/1 interface (fig. 3.6.1).

2) Eliminate the short-circuit on the C.T. (Fig. 3.6.2).

3) Connect the interface to the instrument, always ensuring that voltage and current inputs correspond (Fig. 3.6.3.)

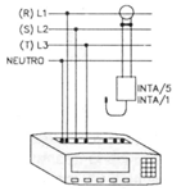


Fig. 3.6.1

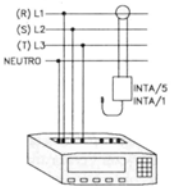


Fig. 3.6.2

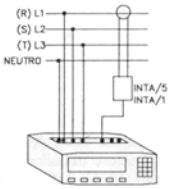


Fig 3.6.3

IMPORTANT: Follow the connection sequences indicated carefully -otherwise the instrument may be seriously damaged.

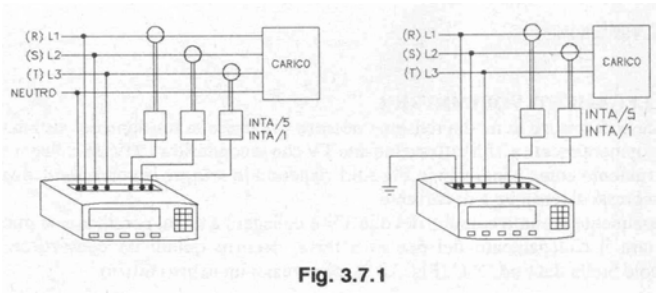


Fig. 3.7.1

Figure 3.7.1 shows two examples of connections with C.T. or clamp meter other than those supplied as standard.

Program the set-up as indicated in paragraph 3.1.7, selecting "4- WIRE" or "3-WIRE" as appropriate and program the C. T primary winding value.

SPECIAL CONNECTIONS (Not usual)

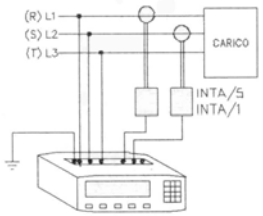


Fig 3.7.2

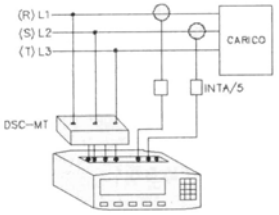


Fig 3.7.3

Figure 3.7.2 shows an example of a 3-wire standard connection with transformer having star-connected secondary winding with central connector earthed (grounded).

When using transformers with delta-connected secondary winding (Fig. 3.7.3) and thus without earthed (grounded) central connector (no neutral) or with potential differences between the earth (grounds), a Delta Star interface is required: this has to be capable of operating at phase to phase voltage of the application.

MEDIUM VOLTAGE

VOLTAGE MEASUREMENT CONNECTIONS

For medium voltage measurements, the voltage of the three phase system (generally of 3-wire type) must be obtained by means of two V.T.s (voltage transformers) with secondary winding at 100 V, which are connected to the instrument as shown in Fig. 3.8.1, ensuring that the voltage and current connections are made to the correct terminals. Normally, the common of the two V.T.s is connected to earth (ground), meaning that the neutral cannot be connected to earth (ground). A Delta Star convertor of type DSC-MT (fig. 3.8.2) is therefore required to create a false neutral.

N..B...
The DSC-MT convertor, available as an accessory, is designed far use with V.T.s only and can therefore withstand max. 120 VAC.

Program the set-up as explained in paragraph 3.1.7, selecting "MEDIUM VOLTAGE" and "3 W IRE" and setting the V. T. primary winding voltage.

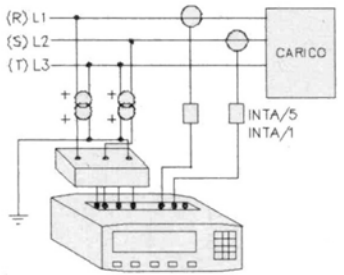


Fig 3.8.1

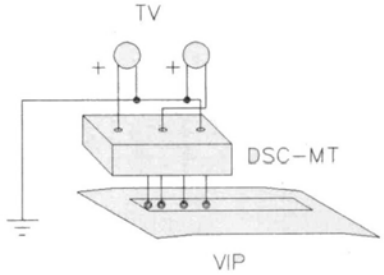


Fig 3.8.2

In the case of V.T. with secondary value other than 100 V program a value corresponding to:

$$\frac{\text{V Primary} * 100}{\text{V Secondary}}$$

CURRENT MEASUREMENT CONNECTIONS

For medium voltage measurements C.T.s must be used; these are connected to the instrument by means of an interface.
Normally, one C. T. terminal is connected to earth (ground) in common with the others (Fig. 3.9.1, Fig. 3.9.2.).

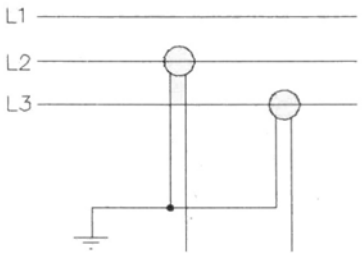


Fig 3.9.1

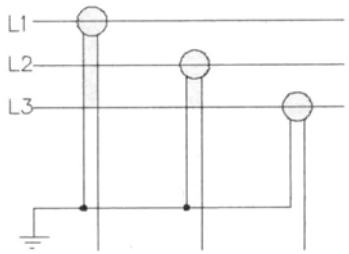


Fig 3.9.2

When using INTN5 interfaces remember that there is no galvanic separation, meaning that the instrument ground is connected straight to the circuit. However, it must be ensured that there are no extra voltages between earth (ground) and the instrument earth (ground), and in any case that no conditions which may lead to instrument damage in any way are present. Otherwise, an insulating transformer (Fig. 3.10.1) or the special SEPN5X3 (Fig. 3.10.2) available as an accessory must be used.

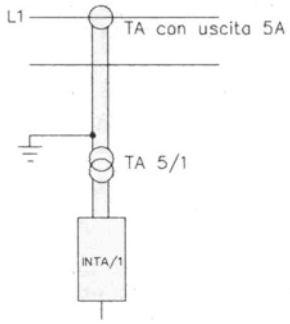


Fig 3.10.1

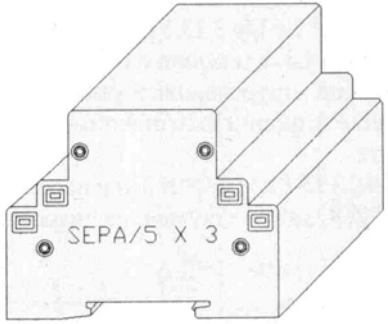


Fig 3.10.2

SINGLE-PHASE MEASUREMENTS

For measurements on single-phase circuits. use the inputs of instrument phase L 1 only (current on connector L 1 and voltage between connectors L 1 and N, as shown in Fig. 3.11).
The wires of the other phases must be connected together and to neutral to prevent false measurements caused by the inputs in open-circuit condition.

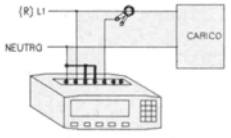


Fig 3.11

Program the set-up as explained in paragraph 3.7.1 , selecting "4- WIRE" connection.

AC/DC MEASUREMENTS

When measuring on DC circuits or systems or those in AC with overlapping DC components (such as inverters. U.PS.. rectifiers). Hall-effect clamps specially designed for this type of measurement must be used: these are available as optional accessories.
Connection to the instrument is by means of an ADAPTA-1V/1V adaptor as shown in Fig. 3.12.1 (always using the L 1 phase inputs) and in Fig. 3.12.2 and Fig. 3.12.3 for three-phase systems (always ensuring that voltage and current inputs correspond).
The clamp meter can be positioned without reference to current direction since the instrument itself will reverse this if incorrect.
The VIP SYSTEM 3/MK 3 does not require special presettings for AC/DC measurements except for the normal set-up programming phases.

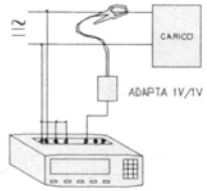


Fig 3.12.1

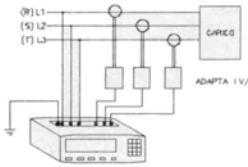


Fig. 3.12.2

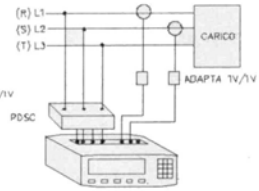


Fig. 3.12.3

When using ordinary commercially-available Hall-effect clamps, remember that the instrument will accept a **maximum input signal of 1 V.**

3.1.4 Connections to peripherals

VIP — HOST

PIN	FUNCTION	PIN
1	DCD	N.C.
2	RX	2
3	TX	3
4	DTR	6
5	GND	7
6	DSB	20
7	RTS	5
8	CTS	4
9	N.C.	N.C.

Fig. 3.13.1 Connection to HOST COMPUTER
N.B. For IBM AT type see p.122

VIP — PRINTER

PIN	FUNCTION	PIN
1	DCD	N.C.
2	RX	2
3	TX	3
4	DTR	N.C.
5	GND	7
6	DSB	N.C.
7	RTS	N.C.
8	CTS	20
9	N.C.	N.C.

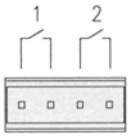
Fig. 3.13.2 Connection to REMOTE PRINTER

VIP — MODEM

PIN	FUNCTION	PIN
1	DCD	N.C.
2	RX	3
3	TX	2
4	DTR	20
5	GND	7
6	DSB	6
7	RTS	N.C.
8	CTS	5
9	N.C.	N.C.

Fig. 3.13.3 Connection to MODEM

Alarm relay connection



30V≂ 0.5A≂10W

Fig. 3.14 Morsetti di uscita allarme

The circuits of equipment without earthling must not be connected to the alarm outputs.
For inductive loads install a suitable quenching circuit (diode if used in DC; RC group of 33 ohm 0.1 F if in AC)

3.1.5 Auxiliary measurement connections

Signal input is by means of the AUX connector on the rear of the instrument.

PIN	SYMBOL	DESCRIPTION
1	VEE	−10,5 VDC Max 25 mA
2	ANAGND	Analogic Ground
3	ANAUX	Analog Input F.S. 1 Vrms
4	VCC	+5 VDC Max 50 mA
5	ANIMP	B.B. Service Bit
6	GND	Digital Ground
7	ANAUX1	Analog Input F.S. 1 Vrms
8	VDD	+10,5 VDC max 25 mA

Fig. 3.15 Connettore AUX

3.1.6 Switching on the instrument

The instrument is switched on by actuating the ON-STANDBY switch on the rear.
After switching on. the following messages will appear on the display without any operator commands being necessary.
1 -The display will fill up with all the alpha-numerical characters available. which will remain visible for several seconds. This indicates that the display testing procedure has been carried out with positive results.
2 -The message TEST OK will then appear on the display and remain there for several seconds. This confirms that the checks on communication with the printer drive and measuring drive have given positive results.
3 -The next display page relates to the optional operational modes. One of the following two pages will appear

Fig. 3.16

Fig. 3.17

The page shown in Fig. 3.17 may change depending on the optional present. (SYSTEM 3 only)
If the operator intends to use one of these options. they must be inserted (and removed when no longer required) with the instrument switched off.
4 -The display then shows measuring page 1.

N.B.: If the instrument has never been used , it will retain the factory presettings (default data):4-wire connection, Low Voltage, full scales 1000 Amp and 600 Volts, *Cosø* = 1, integration time 15'. If the operator requires different settings, the default settings must be modified using the procedure described in the next paragraph.

3.1.7 Initial presetting procedures

The initial instrument setting procedures are activated by following the instructions contained in the display page which carries the main menu.
The last line of each display page shows the functions of the function keys below at that moment.
For example, on page 1 (see Fig. 3.18), if the function key under MENU (4th from the left) is pressed the main menu appears on the display. The setting and selection pages are then called up using a system simplified by the use of operator prompts.

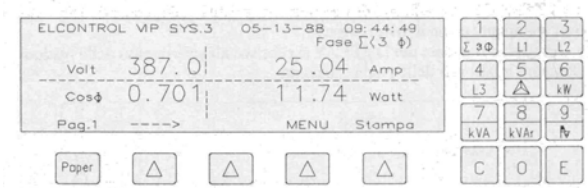


Fig. 3.18

The procedure is as follows:

-The [O] key on the keyboard is pressed for access to the SET-UP display page. -Key [1] on the keyboard is pressed for the display page for selection of the type of circuit connection required (see Fig. 3.19) The choice is between a star connection (4-wire three phase systems) and delta connection (3-wire three phase systems).

Fig. 3.19

For measurement on a single phase system, a star connection should be selected.
Press [1] for 4-wire connection.
Press [2] for 3-wire connection.

N.B.: The presence of a number in reverse (white digit on black background) indicates a previous connection type setting. If this selection is to be confirmed, press the number indicated again to pass to the next page. If a different setting is required, press the key with the new number; the REVERSE character position will shift and the next page displayed.
-The next display page (see Fig.3.20) allows selection of the voltage level: Press [1] for systems at less than 600 Volts (L. V.)
Press [2] for systems at more than 600 Volts (M. v:)

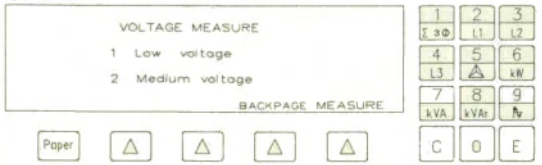


Fig. 3.20

In the second case the instrument voltage connections are made using a V. T
as shown in Fig. 3.21.
Even if a selection has already been made (indicated by the character in reverse) one of the two keys [1] or [2] must be depressed to pass to the next display page (see Fig. 3.21) whose first line refers to current and voltage full scales.

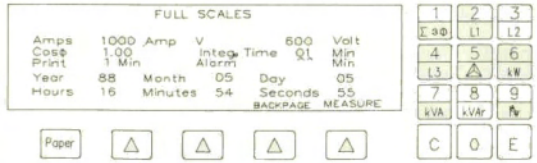


Fig. 3.21

Current full scale
Current full scale is expressed in a number of up to 6 figures.
The current full scale value which should be set depends on the type of clamp meter or CT used.

Follow the indications in the chart below:

With 1000/1 clamp meter provided:	Full scale current = 1000A
With optional 3000/1 clamp meter:	Full scale current = 3000A
Optional C.T. and INTA:	Full scale current = CT primary current
P.I. 30A interface	Full scale current = 30A
AC-DC clamp meter:	Full scale current = 1000A

If no setting is made, the full scale current will be 1000 Amps; i.e. the correct value when using the clamp meter supplied with the instrument.

The full scale setting procedure is prompted by a flashing arrow on the display which moves from one parameter to another when key [E] on the keyboard is pressed.

The sequence is as follows:

- The arrow is positioned on the last figure of the current value previously set

0 1 2 3 4 5 < Amps

- Key [C] is pressed to cancel the previous value

000000 Amp ('0' flashes).

-The numbered keys are pressed to set the full scale required: these values are confirmed using [E] .

Far example, to set full scale 1000Amp:

Press [1] -The display shows Amp 00000 1
Press [O] -The display shows Amp 00001 0
Press [0] -The display shows Amp 00010 0
Press [0] -The display shows Amp 00100 0

The flashing arrow leaves the current full scale field and passes to the voltage full scale field.

Voltage Full Scale.
The voltage full scale value to be set depends on the voltage type selected previously.

- -For monitoring Low Voltage systems, the voltage full scale setting is fixed at 600 Volts max
- -For monitoring Medium Voltage systems, the voltage connection is made using two VTs with secondary winding voltage of 100 Volts: in this case, the voltage full scale setting must be equal to the VT primary winding voltage.

If this setting is not made, a full scale of 600 Volts is taken by default.
Voltage full scale setting procedure is exactly the same as that already examined for current full scale.

- [C] is pressed to cancel the figures expressing the full scale values set previously.
- The numerical keyboard is used to set the figures of the new full scale value.
- Key [E] is used to confirm the value set using the keyboard and to shift the arrow to the next setting field.

Cosø for Power Factor Correction

The Cosø value is expressed by a number less than or equal to 1, with no more than two figures after the decimal point.

This represents the value to which the power factor is to be corrected: the setting is therefore used to calculate the reactive power (kVArd) required to bring the power factor from the measured value to the preset level.

For example, if Cosø is set here, the meaning of the reactive power readings provided will be interpreted as follows:

Instantaneous kVArd: The reactive power required to bring the instantaneous power factor to 0.9; (varies in relation to the load's instantaneous Cosø».

Average kVArd : The average reactive power required to bring the instantaneous power factor to 0.9 (during the integration time set).

Maximum kVArd : The highest of the values used to calculate the average reading above.

Default value is 1.00
If Cosø value is 1.00, the reactive power kVAr) measurement shown by the instrument will be the reactive power of the load itself.

When the load's instantaneous Power Factor is higher than the power factor correction Cosø set here, the reactive power reading (kVArd) will be preceded by the minus sign.

The Cosø value is set as follows:
-Cancel any previous settings using [C].
-Use the numerical keys and key [E] to KEY IN the numbers making up the Cosø required, in sequence.

Integration time

This is the period of time aver which the measurements used to calculate the average values of kW, kVArd, kVA and distortion are collected.

The integration time is expressed by a two-figure number, and is between 1 and 99 minutes.

If no value is set, the instrument uses the default value of 15'.

If the integration time set is 0 (or if it is cancelled using [C]) no average values are calculated or displayed.

The usual setting procedure is used:
Cancel the existing values, digit new values and confirm using [E].

Print-out time

This sets the time between two consecutive readings printed (by local or remote printer).

The operator sets this time at between 1 and 99 minutes. If no time is set, no values will be printed.

If a timed of zero is set. the instrument will print the values of the selected parameters every 20 seconds.
(Naturally timed local print-out can take place only in the presence of readings for the parameters selected for print-out.)

Setting procedure is as usual:
-Press [C] to cancel any existing values.
-Use the numbered keys and [E] to set and confirm the figures of the print -out time required.

Alarm print-out time

This sets the time between two consecutive print -outs in timed print -out mode in the presence of an alarm (maximum or minimum alarm or hour alarm.)

If the parameters which have passed the alarm thresholds have also been selected for timed print-out, it may be appropriate for the printer to supply readings more frequently while the alarm lasts. The instrument can therefore be asked to print out readings at a shorter time interval than during the normal timed print-out mode.

This alarm time is set between 1 and 99 minutes.

If this time is not set, there is no modification in print-out timing.
If a time equal to zero is set, the alarm print-out interval will be 20 seconds.

The alarm print time is valid for both local and remote printers. The setting procedure is as usual:
- Any existing values are cancelled.
- The figures of the new alarm print time are KEYED IN and then confirmed using [E] .

Date and hour setting

The VIP SYS 3 is supplied set to Central Europe time.
The operator must always check the calendar clock, which may be slow following a general reset or for other reasons, and correct it if necessary.

Each of the 6 values provided by the calendar clock is expressed in two figures:

Year xx Month xx Day xx
Hours xx Minutes xx Seconds xx

(The year is therefore indicated using only the last two numbers
e.g. 1988 = 88).

The procedure for adjusting the calendar clock is as follows:
- Cancel the figures previously set.
- Digit the numbers in the new value using the numerical keys and confirm using [E].

This is the last SET UP procedure. The last pushbutton on the right beneath the DISPLA Y is pressed to return to the 1 st MEASUREMENT page.

N.B. :

1) If one or more existing SETUP values are to be retained for the new monitoring phase. move to the next value by pressing [E] .

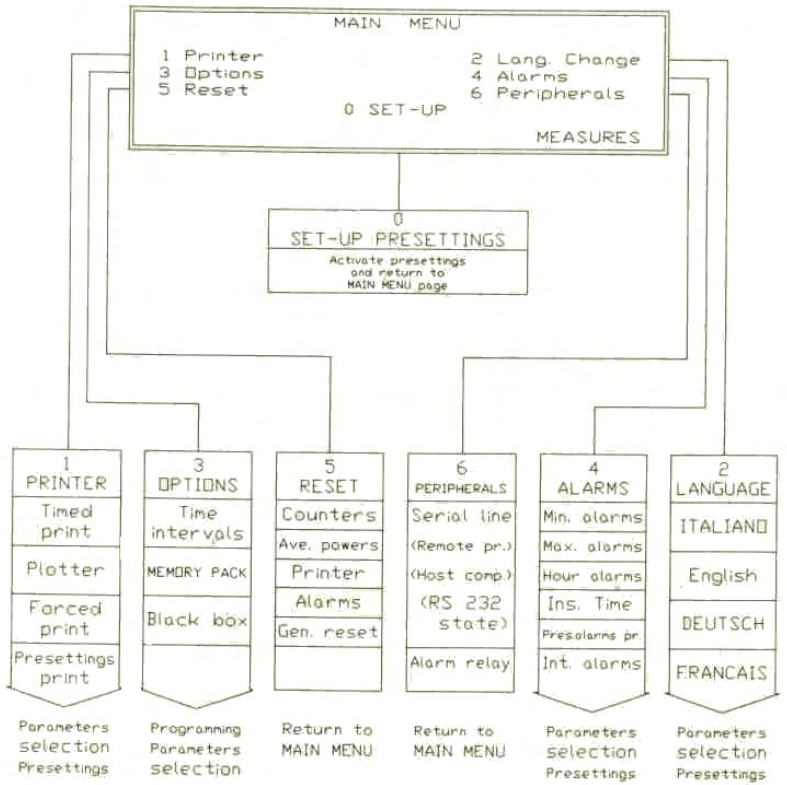
2) The SET UP data are stored in a file supplied by a lithium battery with a life of 5 years.

3) Access to the measurement pages can be obtained from any point in the SET UP procedure by pressing the corresponding function key. This interrupts the SETUP operations at the point reached.

3.2 LOCAL PRINTER

We have already examined the procedure for calling up on the display the pages with the data of the readings in progress, and the sequence for passing from any measuring page to the main menu page.

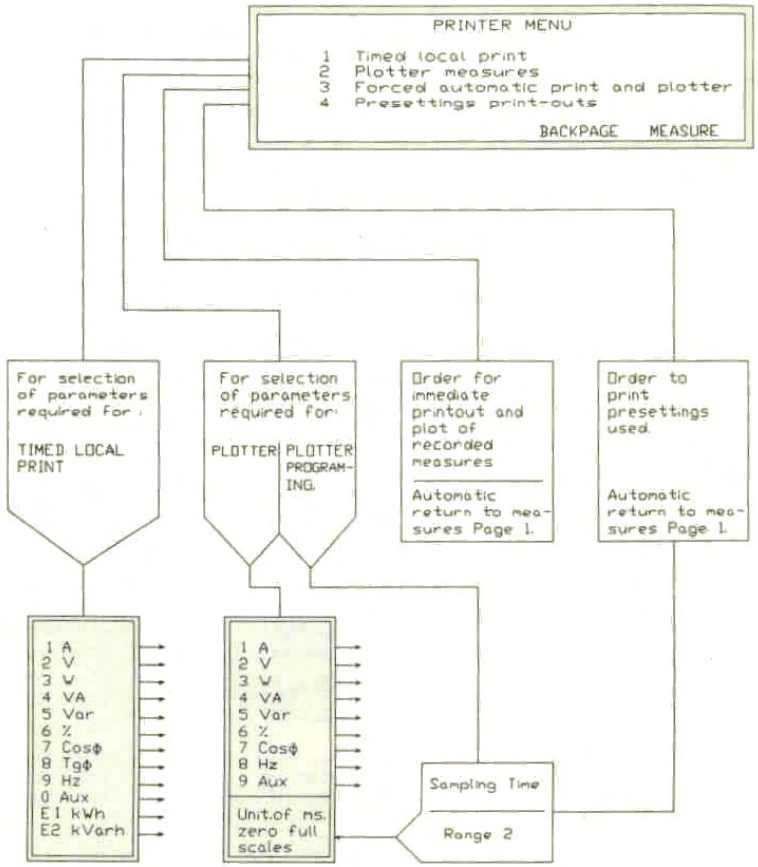
The diagram below shows the passage from the main menu to the selection of the functions to be carried out and the parameters to be monitored.



3.2.1 Printer Menu

From the main menu page, press 1 for access to the printer menu, which is used to choose between two types of print-out.

The display page is also used to give two commands to the instrument:
- Forced automatic print-out
- Presettings print-out.



3.2.2 Timed local print-out

This provides automatic print-out by the instrument printer in accordance with the programmed instructions of the readings for 4 parameters selected by the operator.

The SETUP presettings and the main operations necessary have, already been described in the previous paragraph: we will now take a look parameter selection procedures.
[1] is pressed with the printer page on the display for access to the timed local print-out page, which is used to select the type of parameter for which the data will be printed (see Fig. 3.22),

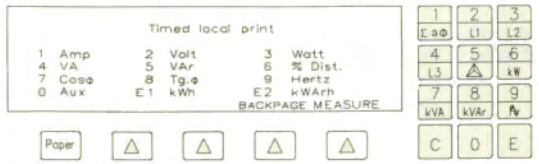


Fig. 3.22

The selection is made by pressing the key with the number (and symbol) corresponding to that of the parameter on the display.
The auxiliary parameter (AUX) can be selected only if the relative Black Box has been inserted in its compartment.
To select parameters marked E1 or E2, press [E] followed by the number key.

After the selection has been made, the number identifying the type of parameter will appear in reverse.
This number will remain in reverse even if the instrument is switched off, and the selection can be cancelled only on the page which indicates selected.

The display pages which follow allow us to choose between the and average values of the selected parameter, and then to select phase.

For example, in Fig. 3.19, if we press [3] the active powers page appears on the display, prompting the operator to choose between the two alternatives (see Fig; 3.23).

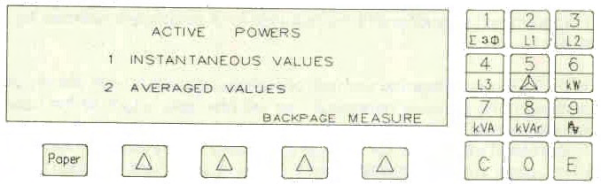


Fig.3.23

If [1] (instantaneous active power) is pressed again, the phase selection page will appear on the display:

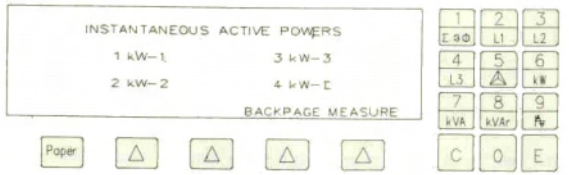


Fig. 3.24

[4] is pressed to complete the selection procedure by indicating that print-out of instantaneous three p ha se active power (kWΣ) is required.

Once the selection has been made, number 4 on the page shown in Fig. 3.23 goes into reverse to indicate the operator's choice; type of parameter selected will also be indicated by a reverse on the previous pages. These numbers will continue to appear in reverse even with the instrument switched off, and the parameters selected remain the same when the instrument is switched on again (they remain unchanged until cancelled).
If the reverse on number 4 of the last display page is removed using key[C]. this simultaneously cancels the active power selections in all the preceding pages.
At this point, to select other kinds of parameter for pri!1t-out (up to 4 may be chosen), return to measuring page 1 by pressing the function key under MEASURE pushbutton, and then press MENU to return to the main menu. Access to the preceding selection pages can be obtained by pressing the function key under BACKPAGE the appropriate number of times.

The procedure for obtaining in bar-graph form of data for two parameters selected by the operator is as follows:
Locate the printer menu and press 2 for access to the plotter measurements page, which is the starting point for the setting and selection procedures which follow (see Fig. 3.25).

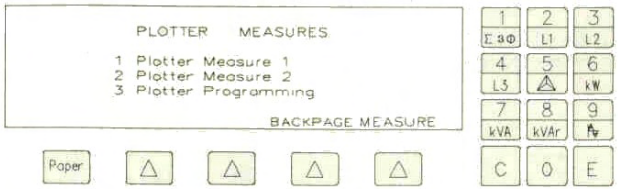


Fig. 3.25

The plotter must first be programmed by pressing [3] for access to the following page:

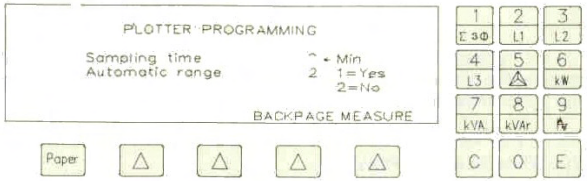


Fig. 3.26

The programming keyboard is used to set the sampling time between 1 and 99 min.) with the usual procedure:
Cancel any existing instructions using key [C]
Use the keyboard to set the new sampling time values and confirm using key [E].
Sampling time equal to zero, or failure to set sampling time will ,make it impossible for the instrument to produce plotter graphs.

The instrument then prompts the operator to select the range of values to be shown on the graph.

[1] is used to select the automatic range, i.e. the zero value is taken as equal to 95% of the lowest value of the 24 recorded, and the full scale as equal to105% of the highest value.

[2] is used to reject the automatic range. In this case the operator must set a range manually during the setting procedures on the plotter selection pages.

Once the plotter function has been set, the operator returns to the measures page 1 (function key under MEASURE) and then to the MAIN MENU in order to obtain access to the plotter measurements page again, to select the two parameters to be monitored by the plotter.
The selection and set-up procedures are as follow:

- Press [1] for display of the list of parameters from which plotter measure 1 can be selected (see Fig. 3.27).

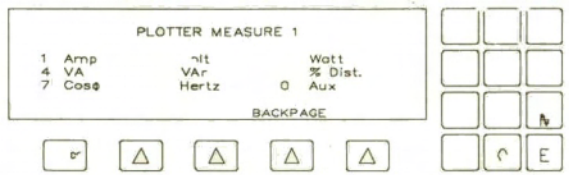


Fig. 3.27

- Select the parameter ta be monitored by the PLOTTER by pressing the corresponding numbered key. For example, to select three phase active power press the following keys in sequence:

[3] - ACTIVE POWER
[2] - AVERAGE ACTIVE POWER
[4] - AVERAGE THREE PHASE ACTIVE POWER

When the selection has been made, a reverse marker will appear beside the kW-Σ symbol on the active power pages (see Fig. 3.28).

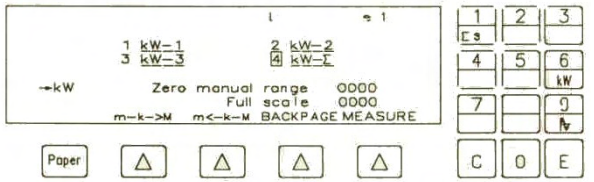


Fig. 3.28

If the operator has chosen the automatic range during the previous programming phase, the display page will not show the last three lines and programming is now complete.

If the manual range option has been selected, the operator must set the following values (which will also appear on the display).

- ZERO xxx (to indicate the minimum power value to be shown on the plotter graph).
- FULL SCALE xxx (to indicate the full scale of the kW axis on the platter graph).
- Kw (to indicate the unit of measurement for the minimum and maximum settings).
- m-k-M (The pushbutton below becomes the multiplier of the unit of measurement: it is pressed once to multiply by 1000).
- M-k-m (The pushbutton below becomes the divisor of the unit of measurement: it is pressed once to divide by 1000).

Manual range is set by the usual procedure:
The mobile arrow starts on the unit of measurement (kW).
Press numerical key 2 or 3 to obtain the multiple or fraction required.

To set Plotter full scale, proceed as follows.

- Using key [E], position the arrow on the full scale.
- Using key [C], cancel any values set previously.
- KEY IN the new full scale value using the keyboard.
- Press key [E] to confirm the new value and to move the arrow to the zero value.
- Repeat the procedure to set the new zero value.

Once all the above steps have been completed, a Reverse will appear beside the selected parameter on all the selection pages up to the plotter measurements page.
To cancel the set of Plotter instructions press key [C] to remove the Reverse from beside the selected value on the last selection page.

To select the 2nd parameter for plotting and set the relative instructions, repeat the above procedure starting from the plotter measurements page and pressing numerical key [2].

As mentioned above, the operator can return to the plotter measurements pages one page at a time by pressing the function key under BACKPAGE a number of times, or by locating measuring page 1 (function key under MEASURE), passing to the main menu page and reaching the plotter measurements page by way of the printer page.

N.B. -Use of the automatic plotter range is certainly simpler. but in this case it may be difficult to compare a series of graphs for the same parameter because of differences in zero and full scale values.

3.3 LANGUAGE CHANGE

The information in the print-outs is always in English, while the symbols used are (as for as possible) international.

The prompts which appear on the display in both measure and procedure pages may be expressed in four different languages.
Press numerical key [2] with the main menu page on the display for access to the language change page which follow.

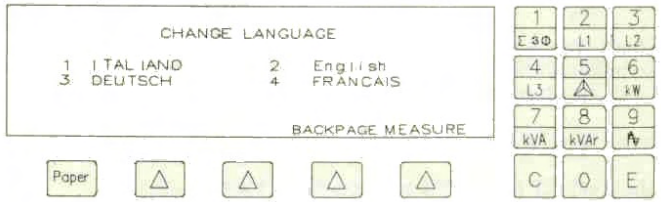


Fig. 3.29

The operator presses the numerical key corresponding to the language required.
In case of total reset of the instrument the language is automatically set to English.

3.4 OPTIONS

The options page is the starting paint for the procedures for activating the following instrument functions:

- Tariff time-band programming
- Use of MEMORY PACK for manual and automatic surveys
- Use of Black Boxes.

3.4.1 Tariff time-band programming (VIP MK3 and SYSTEM 3)

The parameters which can be monitored in each time band are as follow:

4 active power values (kWh of each phase + three phase).
4 reactive power values (kVArh of each phase + three phase).
4 average Tgø values (kVArh/kWh of each phase + three phase)
4 average Cosø values (of each phase + three phase).

If the time bands have been programmed, these measures are shown on the display on pages 11,12,13 and 14.
The instrument also provides total active and reactive power readings, irrespective of time bands set.
All these measurements, which express total energy data since the last RESET, can be indicated on display page 10 or obtained in manual print-out.

Display of time band readings is obtained as follows:

- Give the necessary SETUP instructions.
- Set the beginning and end of each time band. The instrument does not accept zero hour values. the exclusion of interval1. or overlapping intervals.
- Press [3] with the main menu page on the display for access to the operations mode page.
- Press [1] with the options menu on the display for access to the time band page. which is shown in Fig. 3.30

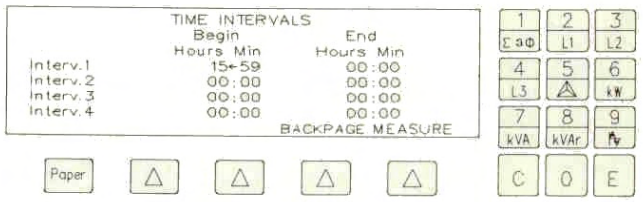


Fig. 3.30

- Using the mobile arrow and the keyboard. set all time interval begin and end times.

Number 1 beside Time Bands on the operations page will go into reverse to indicate that the time intervals have been set.
At this point the current active and reactive energy values (and the corresponding average Cosø and Tgø values) can be located on the display. on pages 11.12.13and 14.

Manual print-out of the data on these pages can be obtained by pressing the PRINT pushbutton. They cannot however be printed by the timed print procedure or charted by the plotter.

The data will be automatically printed out at the end of every period.

3.4.2 Black Boxes and MEMORY PACK, (VIPSYSTEM 3 only)

There are two other options available for use with the instrument:

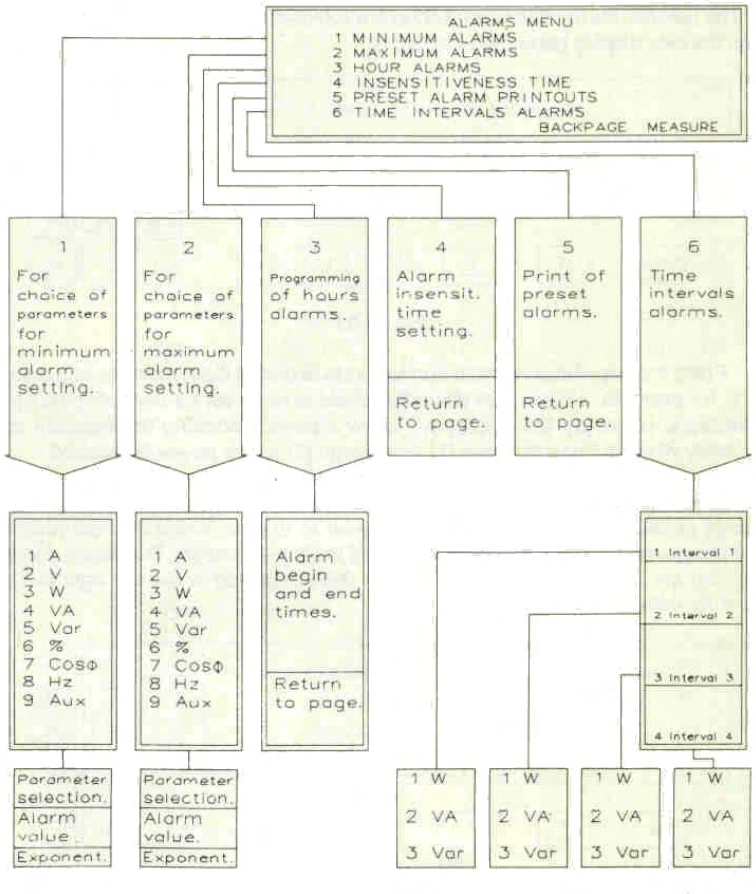
-The MEMORY PACK mass memory, used to automatically stare and measure data.

-The Black Boxes, used to extend and modify the instrument's functions, or to replace them with other completely different monitoring procedures.

The instrument is generally not pre-programmed for these two operation modes: the structure of the Black Box menus depends on the function of the operation mode selected, and they are loaded directly into the instrument when it is switched on.

3.5 ALARMS MENU

Access to the alarm menu is obtained by pressing [4] with the main menu page on the display. This menu is used to select one of four alarm print-out modes.
This alarm page is also used for setting the alarm sensitivity time and for requesting print-out of the preset alarm thresholds.


ALARMS MENU
1 MINIMUM ALARMS
2 MAXIMUM ALARMS
3 HOUR ALARMS
4 INSENSITIVENESS TIME
5 PRESET ALARM PRINTOUTS
6 TIME INTERVALS ALARMS
BACKPAGE MEASURE
1 For choice of parameters for minimum alarm setting.
2 For choice of parameters for maximum alarm setting.
3 Programming of hours alarms.
4 Alarm insensit. time setting.
Return to page.
5 Print of preset alarms.
Return to page.
6 Time intervals alarms.
1 A 2 V 3 W 4 VA 5 Var 6 % 7 Cosφ 8 Hz 9 Aux
Parameter selection.
Alarm value.
Exponent.
1 A 2 V 3 W 4 VA 5 Var 6 % 7 Cosφ 8 Hz 9 Aux
Parameter selection.
Alarm value.
Exponent.
Alarm begin and end times.
Return to page.
1 Interval 1
2 Interval 2
3 Interval 3
4 Interval 4
1 W 2 VA 3 Var
1 W 2 VA 3 Var
1 W 2 VA 3 Var
1 W 2 VA 3 Var

3.5.1 Minimum and maximum alarms.

The instrument can provide immediate signalling by means of print-out on the local printer if and when a parameter selected by the operator exceeds a preset maximum value or falls below a preset minimum.
The instruments prints an alarm line like that shown in Fig. 2.9 in paragraph 2.6.
The operational procedure for selecting the parameter and programming the alarm thresholds is as follows:
-Starting with the alarm menu page on the display, press [2] to locate the type of parameter for which the maximum alarm threshold is to be set.
The parameters for alarm monitoring are selected from amongst those shown on the new display page (See Fig. 3.31).

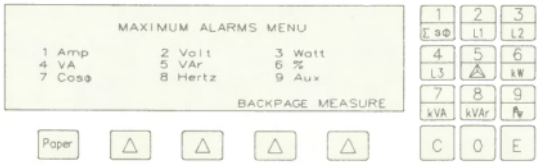


Fig. 3.31

- Press the key whose number corresponds to that of the parameter required. If, for example. a maximum alarm threshold is to be set for the active power measure, press [3] : the display will show a page prompting the operator to specify whether instantaneous [1] or average [2] active power is required.

-Once this has been specified (by pressing [1] or [2] , the display will show a page similar to that in Fig.3.32; this is used to choose between three phase active power (W-∑) or the power of one of the three phases. The alarm value is also set, with its unit of measurement (kW) indicated in the top right hand corner, with the arrow beside it.

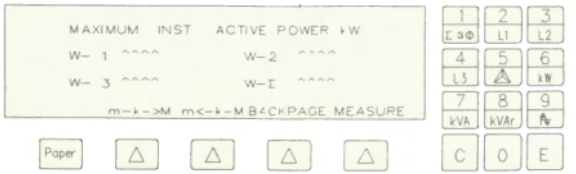


Fig. 3.32

If the power alarm thresholds are to be expressed in a different unit of measurement (MW or W) the exponent must be multiplied or divided by 1000. For example, the third function key from the left is pressed once to pass from kW to W, while the 2nd function key is pressed once to change from kW to MW. The new unit of measurement will appear in the top right hand corner of the display.

Press [E] to confirm the unit of measurement and move the arrow to the parameter to be selected.
I our case, since we intend to select three phase active power, we will have to press [E] four times to position the cursor beside W-∑.

At this point the maximum threshold value in kW is digited using the numbered keys, followed by [E] to confirm.
Once the threshold has been set the selected parameter is signalled in the usual way (reverse alongside) on the last selection page and on the two previous pages.

As already stated, alarm thresholds can be set simultaneously for a large number of parameters selected from those offered on the pages which appear on the display during the selection procedure.

Procedure for setting minimum threshold values for one or more parameters is identical, starting from the minimum alarms menu.

3.5.2 Time alarms

This instrument function is activated by defining the periods during the day during which the print-out time interval will be the same as the alarm print-out interval established during the SETUP phase.

The procedure is as follows:

-Locate the alarm menu and press [3] ; this calls up a display page which shows 4 alarm periods, for which the operator must set the begin and end times (See Fig. 3.33).

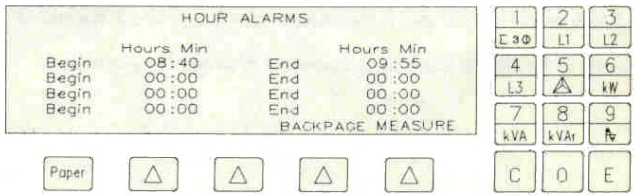


Fig. 3.33

An arrow appears on the first line of this page, prompting the operator to indicate the alarm period begin and end times; these are set using the numbered keys and confirmed with [E] . When the data is confirmed by pressing [E] the arrow moves to the 2nd line.

- If the operator wishes to set a second alarm period, the arrow is already on the second line so he can KEY IN the values immediately.

N.B.: Both times must always be set, and the end time of the first period must always be after the begin time).

3.5.3 Insensitivity Time

This is the minimum time during which the alarm must be activated (or inactive) in order to trigger (or end) an alarm sequence.
(4) is pressed in the alarm menu, the value required is digited using the number keys and (E) is used to confirm.

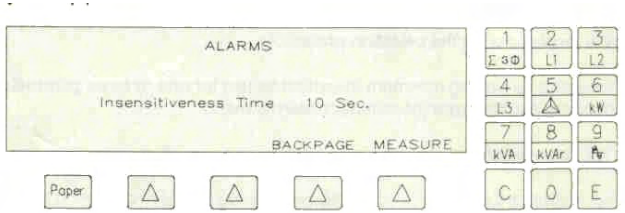


Fig. 3.34

This value is expressed in seconds. If the insensitivity time is equal to zero all the alarms will be disactivated : insensitivity time 1 sec. gives instantaneous alarms.

For example, if insensitivity time 10 sec. is selected all alarms lasting less than 10 sec. will be completely ignored. In the same way, an alarm which disappears for a time of less than 10 sec. is indicated as persisting without interruption.

Key (5) in the Alarms Menu causes print-out of all alarm presettings.

3.5.4 Tariff band alarms

The only parameters for which time interval alarm monitoring can be carried out are the average values for active, reactive and apparent energy consumption; maximum threshold values only are available for three phase powers or for power of each phase individually.
The time bands must first of all be set in accordance with the instructions given in the "options" paragraph. which can be summarised as follows:

Locate the main menu and press [3] to pass to the options menu. Press [1] for access to the time band page.
Using the arrow and the numerical keyboard, set the time band begin and end times.

The alarm setting procedure starts on the alarm menu page

-Press [6] to locate the time interval alarm page, which allows the operator to select one or more of the programmed intervals for alarm monitoring. (See Fig. 3.35). If no time intervals have been programmed, the procedure comes to a halt.

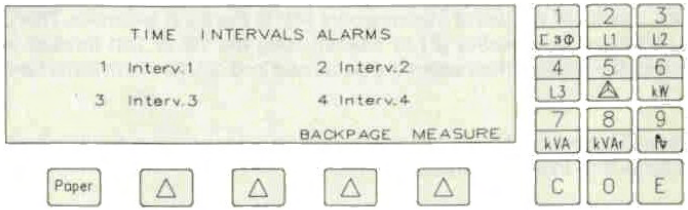


Fig. 3.35

- For example, [1] selects time interval1 for alarm setting,
and calls up the page for selection of the type of parameter for which the alarm value is to be set (see Fig. 3.36).

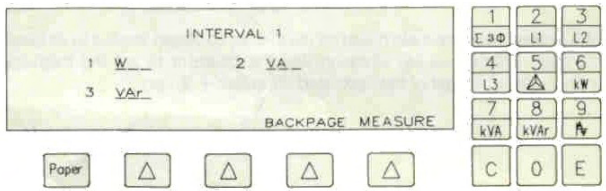


Fig. 3.36

- If for example. [1] is pressed again. the average active power reading is selected for alarm monitoring. The page offering the choice between three phase power and that of an individual phase appears (see Fig. 3.37).

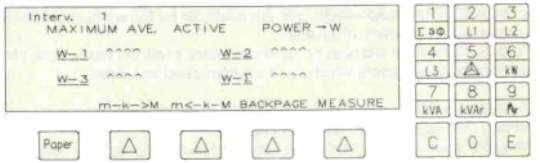


Fig. 3.37

-To continue the selection procedure. indicate the maximum threshold value alongside the parameter (procedure is as described for setting minimum or maximum thresholds in paragraph 3.5.1).

Let us just remind ourselves of this final phase of the procedure, which is prompted by the flashing arrow alongside the parameter to be selected or set. First check that the unit of measurement (kW at top right) is correct. This can be confirmed by pressing [E] or altered using the 1 st or 2nd function key beneath the display. Then select the parameter and set the alarm value beside it.

Naturally alarm thresholds can also be set for other power measurements, in the same time interval or in different intervals.

3.6 RESET PROCEDURE

This is a protected procedure. to avoid the risks deriving from incorrect or un authorised operations.

The operator must therefore be acquainted with a numerical identity code which must be given to obtain access to the reset procedure.

[5] is pressed with the main menu on the display to obtain access to an identity code page (See Fig. 3.38) which invites the operator to set the instrument identity code by means of the keyboard (Number + Enter).

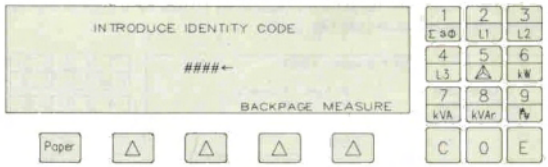


Fig. 3.38

Only if the code is correct will the display turn to the next menu page (See Fig. 3.39) .

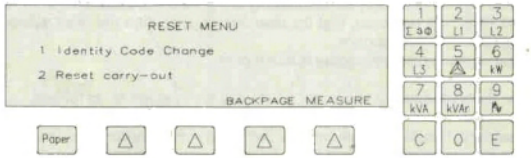


Fig. 3.39

At this point the operator may do one of two different functions:
-[1] can be pressed for access to the procedure for changing the identity code. The page which appears is like that in Fig. 3.40, which prompts the operator to set a new code.

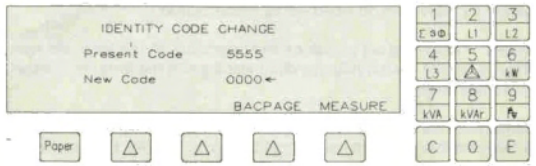


Fig. 3.40

For this procedure, the arrow must be on the second fine. The code is **KEYED** on the numerical keyboard and confirmed with [E]

The second function available is the Reset.

Press [2] with the reset menu on the display for access to a page showing all the reset options available (see Fig. 3.41).

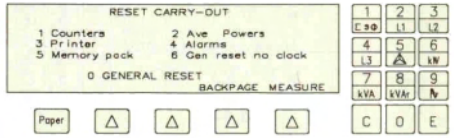


Fig. 3.41

Press the numbered key corresponding to the reset procedure required.
An audio BEEP will be heard, and the operator must confirm the reset selected using [E] within five seconds.
Otherwise the reset procedure is interrupted.

The reset procedures shown on the display are interpreted as follows:

Counters: Resets all active and reactive energy consumption counters (over-all counter and those for each of the 5 time intervals) ; the instrument starts on new counts.

Average powers: Interrupts calculation of all average values and deletes the maximum values registered since the previous reset. The instrument starts logging a new series of maximum values, cancelling the previous measure each time a higher value is obtained. Note that if this reset is carried out together with the energy meter synchroniser signal the measurement obtained will be synchronised.

Printers: Cancels all set up values and selections for the local and remote printers. Only the default data remain, meaning that the instrument must be programmed anew.

Alarms: Cancels all alarm settings (minimum and maximum thresholds, and hour and time interval alarm monitoring). It also cancels the relay setting.

MEMORY PACK: Cancels all data stored on the MEMORY PACK inside the instrument (preset values, programming, measurements etc.)

Gen. reset no clock: Cancels all data stored in the instrument and interrupts all functions: only the calendar clock is unaffected. The default data automatically start up again (see para. 3-9)

General reset: Cancels all stored data, including those in the calendar clock. The default data automatically start up again (see para 3-9).

Keyboard Enable: This function (which intervenes only if the instrument has received a disabling command from the Host Computer) appears on the reset menu page. (fig. 3.39)

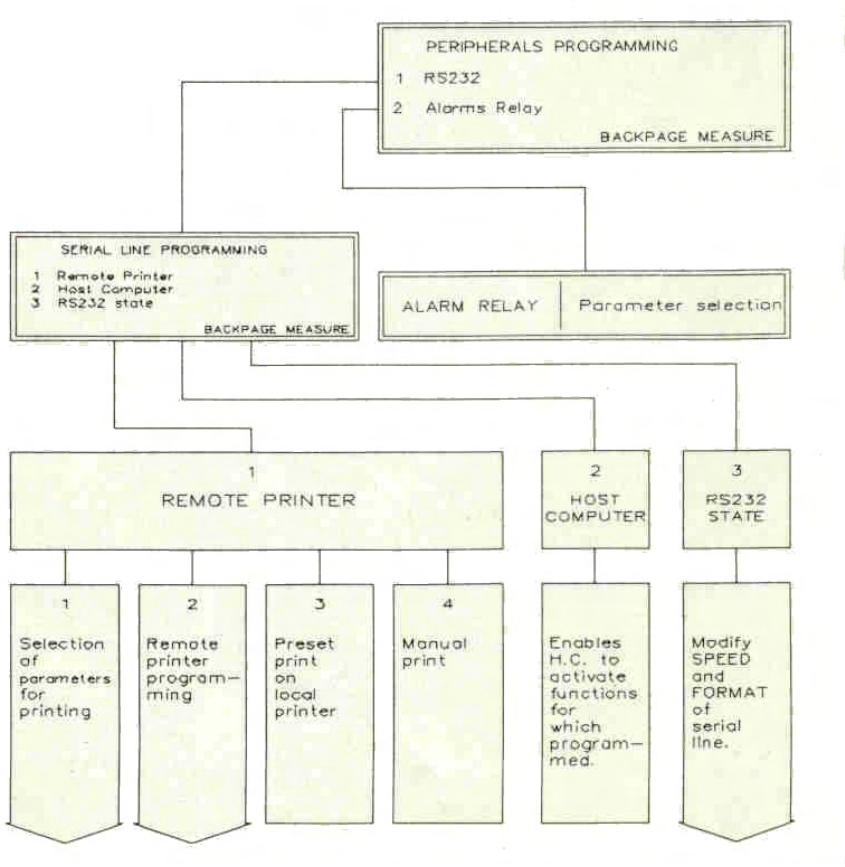
N.B.:
1) The identity code is a 4-figure number which the purchaser can choose and input into the instrument. The VIP SYSTEM 3 / MK 3 is however supplied preset with identity code 5555, which is no longer valid once it has been replaced by the code of the operator's choice.

2) To avoid losing useful data, request a general print-out of the most recent data before starting the reset procedure.

3.7 USE OF PERIPHERALS

There are two kinds of peripherals: those connected to the unit using a serial line and those connected to the alarm relays. Procedures for the two types are different.

In the second case, simply select the parameter to be monitored. The procedure for the use of a remote printer or a Host Computer is much more complex and requires a more thorough examination.



The serial line used to connect the instrument to the peripherals must be adapted to suit the specifications of the remote printer or HOST Computer to be connected.
The display first indicates the serial line's speed and format specifications, and then suggests various possible modifications for the operator to select.

The procedure is as follows:
Press [1] to pass from the peripherals programming page to the serial line programming page. Now press [3] for access to the page which provides display of the RS232 serial line state.
Fig. 3.42 shows an example of a serial line state display, indicating the default data.

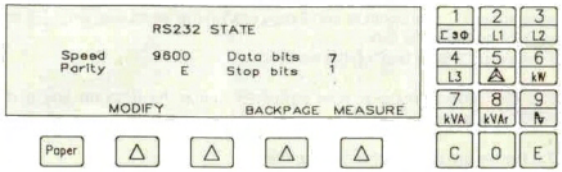


Fig. 3.42

If data must be changed, press the function key under MODIFY beneath the display.
The next page will appear (see Fig. 3.43) : this prompts the selection of a speed different from that specified in the serial line state.

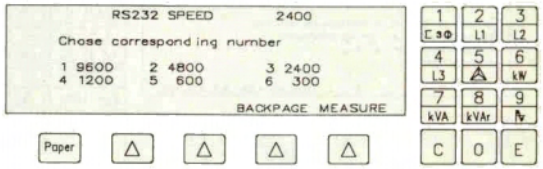


Fig. 3.43

The choice between the 6 possible speeds is made by pressing the numerical key corresponding to the value required, followed by [E] to confirm.

The RS232 format modification page will then appear (See Fig.3.44).

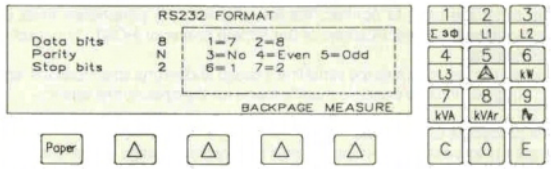


Fig. 3.44

The modification programming procedure requires the use of the numbered keys only.
For example, [1] is pressed to set "7 data bits" on the serial line, while [3] sets "Parity No" on the serial line.
[7] then sets "2 Stop Bits" on the serial line.

Serial line programming is now complete: press the function key under MEASURE to leave the page.

3.7.2 Procedure for use of remote printer.

Selection and pre-setting procedure for the remote printer is as follows:
Locate the peripherals programming display page and press [1] for access to the serial line programming page.
Press [1] for access to the remote printer page (see Fig. 3.45).

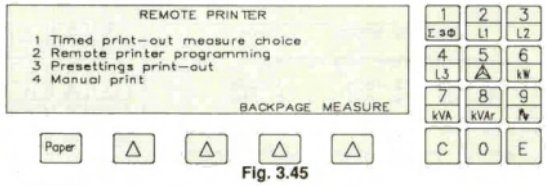


Fig. 3.45

Two kinds of print-out are available:
Timed print-out
Manual print-out.

Selecting parameters for timed print-out

The range of parameters available for selection is the same as for timed local print-out; the only difference is that the remote printer can monitor a larger number of parameters.
Procedure is also exactly as described in paragraph 3.2.2, and the sequence of display pages used Is the same.

A brief reminder: selections are made using the keyboard, and a reverse appears along side the selected parameters, remaining until these are cancelled.

Timed Print-out: Once selection is complete timed local print-out of the measuring lines will begin to take place at regular intervals (print time set in SET-UP phase). The two heading lines appear every 20 lines.

Manual Print-out: press [4] for immediate print-out of the two heading lines and a measuring line for the selected parameter. using the procedure examined previously.
Programmed timed print-out continues after this print-out.

The maximum number of parameters for which print-out is possible depends on the specifications of the remote printer connected to the instrument.
The printer must therefore be programmed. entering all specifications from its data sheet in the instrument.

Programming Remote Printer

Press [2] to pass from the remote printer page to the remote printer programming page shown in Fig. 3.46.

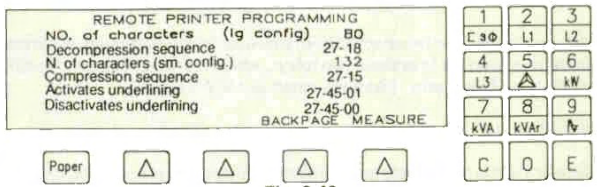


Fig. 3.46

The mobile arrow indicates the parameter for programming: when it is positioned on the first line the operator must enter the number of spaced characters for the printer.

Press [E] to confirm and the arrow will shift to the second line, and so on until programming is complete.

Note that the page illustrated shows the default data for the programming specifications, preset at the factory.

Presettings Print-out. Press [3] to pass from the remote printer page to a page showing all printer and serial line programming data.

N.B. : ELCONTROL offers a Centronix Black Box required for connecting the instrument to a remote printer with parallel input as an optional accessory.
Programming procedure is as described above for serial type connections.

3.7.3 Procedure for use of Host Computer

Locate the serial line programming page (see paragraph 3.7) and press [2] (host computer) to enable the computer connected to the instrument to carry out directly all the functions for which it has been programmed.

The host computer can generally be used to program the instrument, to instruct it to take measurements, or to transfer the contents of the MEMORY PACK.

ELCONTROL recommend the use of a program available as an optional accessory far this function. Clearly, whatever function the host computer is to perform, the serial line must first be programmed to the host computer specifications (see paragraph 3.7.1).

3.7.4 Use of alarm relay

Two parameters can be selected from those for which maximum or minimum alarms have been set to activate two relays, which remain activated throughout the duration of the alarm. (Contacts rated at 48v 0.5 A 10W).
Procedure is as follows:

-Check that the parameters and the alarm values which are required to activate the relays have been selected and set in the alarms menu procedure. If not, set them immediately.

-Return to the main menu and press [6] for access to the peripherals menu.

-Press [2] to select the alarm relay function.

The page offering the choice between relay 1 and relay 2 will appear (see Fig.3.47).

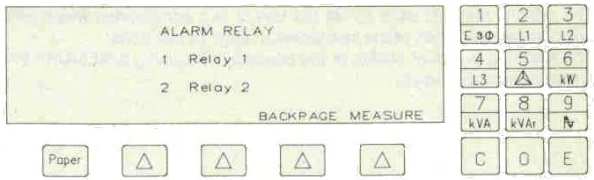


Fig. 3.47

After selecting the relay required. the page shown in Fig. 3.48 offering the choice between minimum and maximum alarms will appear.

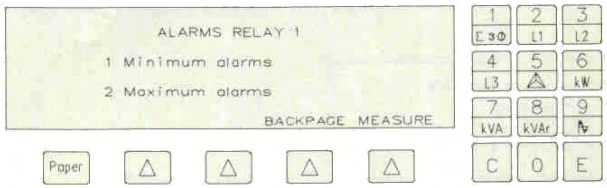


Fig. 3.48

-The type of parameter must now be selected: a display page showing 9 parameters, as in the alarm print-out procedure, will appear for this purpose (see Fig. 3.49).

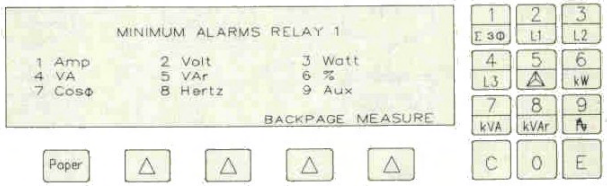
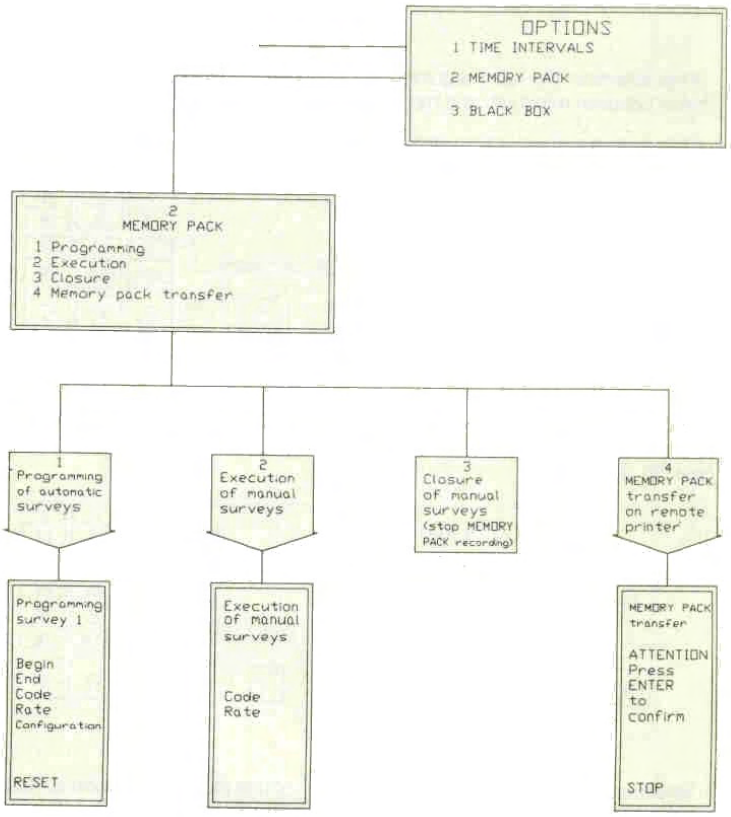


Fig. 3.49

Selection is made as in timed print-out. except that the final selection is made by depressing the numbered key corresponding to the number by the parameter, and not by setting the alarm value.

3.8 MEMORY PACK SURVEYS (SYSTEM 3 ONLY)

The options is used to set the use of two accessories which offer a considerable expansion of the instrument's range of functions.
The following is a brief outline of the procedure for using a MEMORY PACK for measurement surveys



Survey Procedure

A measuring survey is generally carried out in a sequence of four phases (Programming -Execution -Termination -Print-out of MEMORY PACK.) Their relative importance is different in automatic and manual surveys.

Automatic Surveys

In this case the operator programs an entire cycle of surveys, all relating to the same point in a system.

During the survey programming phase, the operator programs and enters the following information on the MEMORY PACK: survey begin and end dates and hours; identity code for each survey; survey measuring rates; SET UP presettings required.

Different SET UP presettings can be used in each survey: the operator can load SET UP data specially entered in the programming instrument onto the MEMORY PACK by instructing the system to record the existing configuration; or he may simply use the instrument SET UP data, which the MEMORY PACK reads during the survey.

After the surveys have been programmed (this may be done OFF LINE before the execution phase) the operator inserts the MEMORY PACK into the instrument on site, makes the necessary connections to the system, and may then leave the instrument to carry out the surveys. The first survey will start at the programmed time, and will be followed by the other surveys according to the preset timetable. The operator can collect the MEMORY PACK at the end of the last survey and then print out the MEMORY PACK data OFF LINE. It will be noted that in automatic mode the execution and closure phases take piace automatically at the programmed dates and hours.

The programming phase is as follows.

-Locale the options page and press [2] for access to the MEMORY PACK page.

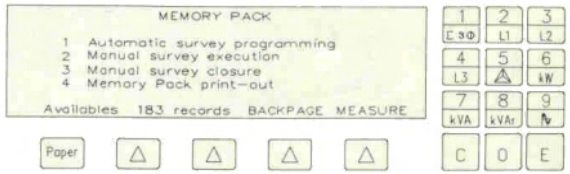


Fig. 3.50

- Press [1] for access to the programming page.

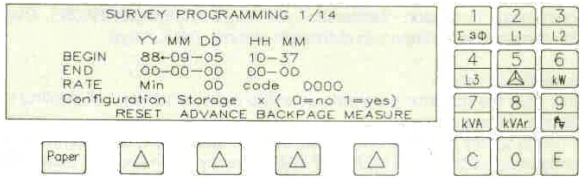


Fig. 3.51

- As prompted by the arrow, set the following data: (digit the numbers and confirm using [E]).
- 1 st line -survey begin data and hour
- 2nd line -survey end data and hour
- 3rd line -survey identity code
- 4th line -survey measuring rate
- 5th line -press [1] to record instrument presettings on the MEMORY PACK (these must have been entered or checked by the operator). Press [O] if presettings are not to be recorded.

- The words RESET and ADVANCE will have appeared at the bottom of the display page: press ADVANCE to pass to the programming page for the next survey or RESET to cancel the surveys already programmed.

- The number of records still available for further surveys is shown at the bottom left of the display page during programming. This number, multiplied by the selected measuring rate, indicates the amount of time which the MEMORY PACK has available for future surveys.

Manual surveys
Manual surveys are used when measurements are to be taken at different points in the same system. Manual surveys are programmed and executed on site. with begin and end instructions given directly by the operator.

The SETUP presettings are made before each survey. and the operator simply gives the start instruction as follows:

- After connecting the instrument to the system and inserting the MEMORY PACK. the operator locates the options page on the display.
- Press [2] for access to the MEMORY PACK page.
- Press [2] again for access to the manual survey execution page.

A page like that shown in Fig. 3.52 will appear on the display.

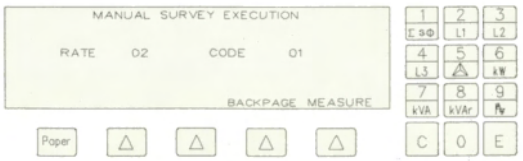


Fig. 3.52

- Using the numerical keyboard and [E], digit and confirm the survey identity code followed by the measuring rate.

The survey execution phase starts as soon as the operator has set the measuring rate; during this phase the display shows measuring page 1 (the starting point for an other simultaneous measuring procedures).

To terminate the survey. return to the MEMORY PACK page and press [3] .This interrupts execution of the manual survey.

The operator can now connect the instrument to another point in the system and carry out a new manual survey, with different measuring rate and SET UP data if required.

He may also program an automatic survey cycle as previously described. The other alternative is to pass to the MEMORY PACK transfer phase.

ATTENTION : The MEMORY PACK must always be inserted or removed with the instrument switched off.

MEMORY PACK Transfer
Survey data are printed on the remote printer, meaning that the printer and serial line must first be programmed as explained in paragraph 3.7.1 and 3.7.2.
The operator must also select the parameters for which print-out is required (up to 8, 13 or 23 parameters depending on the printer).

[4] is pressed to start the MEMORY PACK transfer: the display will show an ATTENTION page as shown in Fig. 3.53, which instructs the operator to press [E] to confirm the survey data transfer request.

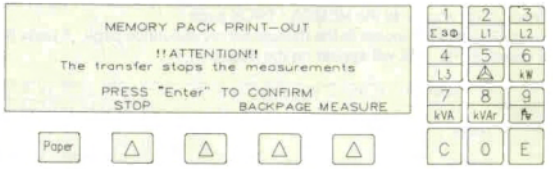
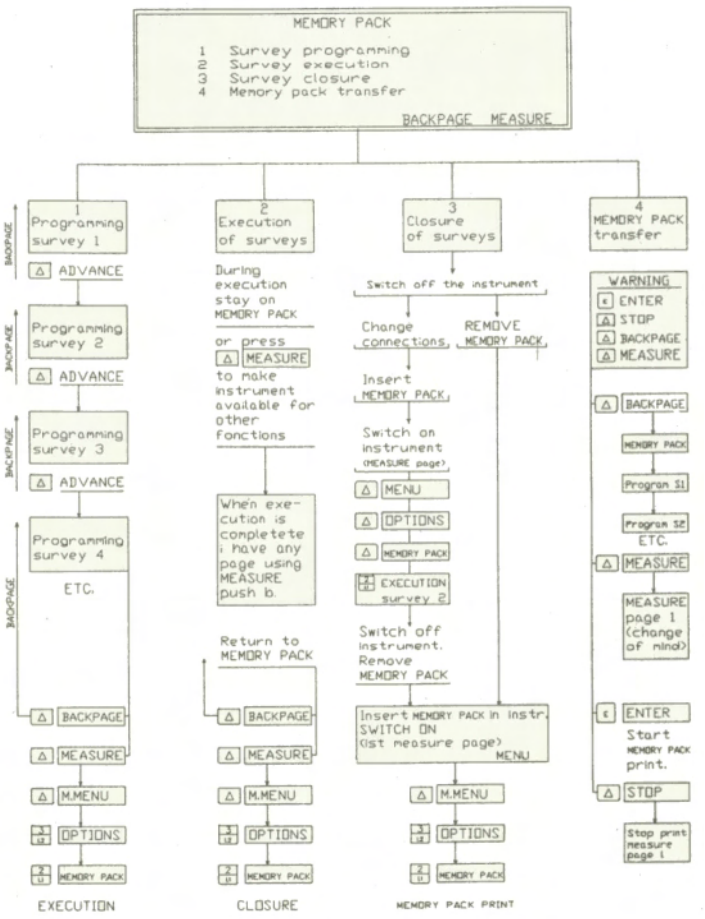


Fig. 3.53

The last line of this page also include the STOP command, which is given using the function key below it.
This enables the operator to halt the MEMORY PACK transfer and return to measuring page 1.

Finally, remember that the entire contents of the MEMORY PACK can be transferred onto a magnetic disk using a suitably programmed host computer connected to the instrument by means of an RS232 serialline.

MENORY PACK USAGE PROCEDURE DIAGRAM FOR MEASUREMENT SURVEY



3.9 DEFAULT VALUES

As has been seen, the operator must carry out the SETUP presetting procedures before using the various functions, while for the peripherals the serial line and remote printer data must also be entered. The instrument is however supplied with some programming data already set. These are the "default" data, which the operator may modify as already de- scribed.

<u>SET UP Default Data</u>

4 w ire connection
Low voltage measurements
Voltage full scale 600 Volts
Current full scale 1000 Amps
Cosφ = 1.00
Integration time 15'

Default reset identity code: 5555

<u>Default serialline programming</u>

9600 Baudes
Data bits
1 Stop bit
E EVEN parity

<u>Default values for remote printer</u>

N. of characters (Ig. config.) 80
Decompression sequence 27-18
N. of characters (sm. config.) 132
Compression sequence 27-15
Activates underlining 27-45-01
Disactivates underlining 27-45-00

4. TECHNICAL FEATURES

4.1 GENERAL SPECIFICATIONS

Display: LCD multiplexed with SUPER TW type liquid. Display structured in 256x64 pixel, divided into 8 lines of 40 characters.
Guaranteed operating life: at 40°C (104°F) 20% Relative Humidity (RH) = 1000 hours; 0°C (32°F) 60% RH = 200 hours.
Guaranteed storage life: 40°C (104°F) 90% RH = 200 hours; 60°C (140°F) 20% RH = 200 hours; -20°C (-4°F) 60% RH = 200 hours.

Unit : m, k, M, V, A, W, VA, VAr, Hz, 'Nh, Cosφ, Tgφ.

Function change: Using keyboard or RS232.

Sample rate: 1 sample/sec.

Range change: Automatic; passage to upper range occurs at **110%** of present range: passage to lower range occurs at 20% of present range.

Range change response lime: 1 sec.

Inputs: L 1, L2, L3, N, |1, |2, |3, AUX.

Inputs characteristics: L 1 to N, L2 to N, L3 to N = 600 VAC from 30 to 1000 Hz or 600 V DC. Input resistance = 4MΩ |1, |2, |3, AUX= 1 Vrms from 30to 1000 Hz or 1 V DC. Input resistance = 6K.Ω.

Outputs: 2 relays: contact specifications: 30 VAC/VDC, 1A.

External control: RS232C

Clock: Internal, quartz, visible on display and in print-out, showing year, month, day, hours, minutes and seconds.

Microinterruption: 2,5 mSec min on the mains supply

Operating temperature: From 5°C to 40°C (41°F to 104°F)

Humidity range: From 20% to 80% RH

Storage temperature: From -20°C to + 60°C (-4°F to 140°F}

Maximum time permissible at high ambient temperature and high relative humidity: A.T = 40°C (104°F) RH= 80% Max time = 80h

Maximum storage time: A.T = 25°C (77°F) RH = 400/0 Max. time = 6 months
A.T = -20°C (-40°F) -or + 60°C (140°F) Max. time = 150 hours.

Warm-up time: 10 minutes (to meet all specifications).

Condensation: Not permitted.

Insulation resistance:
≥: 500 MΩ. between input connectors and external casing between current tap and external casing between input connectors and relay outputs.
≥: 2 MΩ. between voltage inputs and current inputs between voltage inputs and AUX input between voltage inputs and RS232C output

Breakdown voltage: Between input connectors (including Neutral connector) :
Test at 2000 Vrms 50 Hz for 60 sec.
Between each connector and casing: Test at 3000Vrms for 60 sec.

Power supply source: Internal by means of rechargeable nickel cadmium battery 1300 mA/h or external by means of mains supply 200-240 V- 50/60 Hz (100-120V- 50/60 Hz on request).

Power Consumption:10VA

Battery: 2 batteries, 1 NI-CD to allow the instrument to continue functioning in case of power line (mains) supply failure, the other LITHIUM for data protection.

NI-CO BATTERY: 5V; 1300 Ma/h, recharge time 48h (with mains supply), 60 min. with FBC1 (fast battery charger) module; estimated life 3 years at 20°C (68°F), recharge cycles = 500.

LITHIUM BATTERY: 3V, 500 mA/h; data protection and estimated life, > 5 years.

Battery operating period: 3 hours (without print-out or display illumination).

External dimensions: 240x220x115 mm ($9\ _{7/16}$ x $8\ _{11/16}$ x $4\ _{1/4}\ ^{in}$)

Weight: 2.25 kg (4.95 Ibs)

4.2 SAFETY

Class: 1 to IEC 348 and VDE 0411 norms.

4.3 MEASUREMENTS:

Method: Variable sampling and analog/digital conversion.
Variable sampling is a function of the frequency reading on phase L 1.

Sampling frequency: 4 kHz

Number of samples far each phase: 400 (100 mS)

Automatic offset compensation: Every minute

Type of connection: 4 wire, 3 wire.

Sample rate: 1 sample/sec.

4.4 ACCURACY

Error limits: Expressed as +/- [% reading + % full scale] applied after 10 minutes of warm-up with power source battery or mains at rated voltage {230 VAC + /- 1 % 50 Hz +/- 0.1 Hz) with ambient temperature from 18°C (64°F) to 25°C (77°F); outside this range the error expression becomes + /- [% reading + % full scale + 0.02% of full scale per OC] .

Voltage measures

Sensitivity, Full scale and accuracy of AC Voltage

Nominal range	Sensitivity	Full Scale	ε from 20% to F.S.	
			VIP SYSTEM 3	VIP MK 3
6 Vrms	2 mV *	6.000 V	0.2%F.S. +0.3% Rdg.**	0.3%F.S. +0.4% Rdg.**
27 Vrms	9 mV	27.00 V	0.2%F.S. +0.2% Rdg.**	0.3%F.S. +0.3% Rdg.**
130 Vrms	45 mV	130.0 V	0.2%F.S. +0.2% Rdg.**	0.3%F.S. +0.3% Rdg.**
600 Vrms	200 mV	600.0 V	0.2%F.S. +0.2% Rdg.**	0.3%F.S. +0.3% Rdg.**

* * The error is measured by synchronizing the voltage frequence with the circuit frequency (only for measurements of voltages whose frequence is the same as the instrument power source frequency with the instrument supplied from the mains power supply).

Sensitivity, Full Scale and accuracy of D C Voltage

Nominal range	Sensitivity	Full Scale	ε from 20% to F.S.	
			VIP SYSTEM 3	VIP MK 3
6 Vrms	3 mV *	6.000 V	0.2%F.S.+ 0.6% Rdg.**	0.3%F.S.+ 0.6% Rdg.**
27 Vrms	14 mV	27.00 V	0.2%F.S.+ 0.3% Rdg.**	0.3%F.S.+ 0.4% Rdg.**
130 Vrms	65 mV	130.0 V	0.2%F.S.+ 0.3% Rdg.**	0.3%F.S.+ 0.4% Rdg.**
600 Vrms	300 mV	600.0 V	0.2%F.S.+ 0.3% Rdg.**	0.3%F.S.+ 0.4% Rdg.**

* Minimum measurable signal is 300 m V

Input resistance: min 4 MΩ
Overload protection: 720 Vrms or 1.2 kV (peak)

Current measurements: With direct input max. 1 Vrms at full scale

Sensitivity, Full Scale and accuracy of AC Current

Nominal range	Sensitivity	Full Scale	ε from 20% to F.S.	
			VIP SYSTEM 3	VIP MK 3
10 mVrms	3 µV *	10.00 A	0.2%F.S.+ 0.3% Rdg.**	0.3%F.S.+ 0.4% Rdg.**
47 mVrms	15 µV	46.00 A	0.2%F.S.+ 0.2% Rdg.**	0.3%F.S.+ 0.3% Rdg.**
215 mVrms	70 µV	215.0 A	0.2%F.S.+ 0.2% Rdg.**	0.3%F.S.+ 0.3% Rdg.**
1000 mVrms	300 µV	1000 A	0.2%F.S.+ 0.2% Rdg.**	0.3%F.S.+ 0.3% Rdg.**

Sensitivity, Full Scale and accuracy of AC Current

Nominal range	Sensitivity	Full Scale	ε from 20% to F.S.	
			VIP SYSTEM 3	VIP MK 3
10 mVrms	3 µV *	10.00 A	0.2%F.S.+ 0.6% Rdg.**	0.3%F.S.+ 0.6% Rdg.**
47 mVrms	15 µV	46.00 A	0.2%F.S.+ 0.3% Rdg.**	0.3%F.S.+ 0.4% Rdg.**
215 mVrms	70 µV	215.0 A	0.2%F.S.+ 0.3% Rdg.**	0.3%F.S.+ 0.4% Rdg.**
1000 mVrms	300 µV	1000 A	0.2%F.S.+ 0.3% Rdg.**	0.3%F.S.+ 0.4% Rdg.**

* Minimum measurable signal is 500 µV

Input resistance: min. 6 k.Ω.

Overload protection: 5 times full scale

Crest Factor: 1.7 on V and I at 600V 1000A

Frequency measures:
Accuracy in frequency from 30 to 100 Hz = 0.03% of reading + /- 0.1 Hz;
Accuracy in frequency from 101 to 500 Hz = o.~/o of reading + /- 0.1 Hz;
Accuracy of frequency from 501 to 999 Hz 0.5% of reading + /- 0.1 Hz.

V I vs signal frequency errors:
20, 30, 40, 50, 60, 70, 80, 90 Hz no errors beyond those indicated in the above tables;

Secondary parameters:
Secondary parameters are all parameters measured by instrument except V and I. The error on the main secondary parameters (R S, and single phase and three phase cosφ) is the sum of the errors on the main parameters (V+ I). The errors on the other secondary parameters can be calculated from the equation which defines them in paragraph 4.11 of this manual.

4.5 AC CLAMP METER 1000A/1Vrms

Measuring range: From 0.05 to 1000A

Frequency range: From 48 to 1000 Hz

Ratio: 1000A/1Vrms

Accuracy:
+ /- 0.5% Rdg.+ /- 0.05A from 10A to 1000A angle error < 30 minutes.
+ /- 0.8% Rdg.+ /- 0.05A from 2A to 10A angle error < 60 minutes.
+ /- 1.5% Rdg.+ /- 0.05A from 0.05A to 2A angle error < 90 minutes.

Dielectric strength: 2000V 50 Hz for 1 min.

AC Current: With clamp meter 1000/1Vrms used as current transducer

Sensitivity, Full Scale and precision of AC Current

Nominal range	Sensitivity	Full Scale	from 20% to F.S. VIP SYSTEM 3
10 A	3 mA *	10.00 A	0.2%F.S.+ 0.3% Rdg.** + Clamp meter error
47 A	15 mA	46.00 A	0.2%F.S.+ 0.2% Rdg.** + Clamp meter error
215 A	70 mA	215.0 A	0.2%F.S.+ 0.2% Rdg.** + Clamp meter error
1000 A	300 mA	1000 A	0.2%F.S.+ 0.2% Rdg.** + Clamp meter error

* Minimum readable signal is 500 mA

Input resistance: 50 MΩ.

Overload protection: max 1200 A

4.6 PRINTER SPECIFICATIONS

Number of columns: 40

Characters: Matrix 5x7

Print speed: 1 line for second

Paper: 55g/m^2 pure cellulose, smooth, for data processing system.

Paper width: 57cm

Pager length: 16 mt (52.5 ft)

Print types: Manual, automatic arid plotter (see manual page...)

4.7 DISPLAY SPECIFICATIONS

Display: LCD multiplexed with DUTY 1/64 BIAS 1/9 with SUPER TW type liquid. Display structured in 256 pixel by 64 pixel, divided into 8 lines of 40 characters.

Dimensions: 140 x 40 mm

Maximum acceptable limits: logic power supply = 5V + /- 5%. LCD power supply = max 20V; Operating temperature 0-50°C (32°F to 122°F); Storage temperature -20- + 60°C (-4°F to 140°F).

Electro-optical specifications: At a temperature of O°C (32°F) the LCD supply voltage must be 14V and the response time becomes 800 mS; with temperature 25°C (77°F) the LCD power supply must be 13.2V and the response time becomes 250 mS; with temperature 50°C (122°F) the LCD supply voltage must be 12V. At 25.C (77°C) the display angle is equivalent to 55. (35.+ 20} longitudinal and 60. (30. + 30} lateral.

Guaranteed operating life: at 40°C 20% Relative Humidity (RH) = 1000 hours; 0°C (32°F) 60% RH = 200 hours.

Guaranteed storage life: at 40°C (104°F)90% RH = 200 hours;
60°C (140°F) 20% RH = 200 hours; -20°C (-4°F) 60% RH = 200 hours.

4.8 KIT SUPPLIED WITH VIP MK3/SYSTEM3 ENERGY ANALYSER

- 1 VIP MK 3/ SYSTEM3 ENERGY ANALYSER
- 1 set of voltage measuring cables with fixed banana plug and crocodile clips for measuring max. 250 Vrms from phase to neutral.(440 ph.ph.)
- 3 1000N1Vrms clamp meters 1 power supply cable
- 1 performed case (Aluminium for SYSTEM 3, reinforced plastic for MK 3)
- 2 fuse 5 x 20,80mA T 250V- (160mA T for 100-120V- operation).
- 1 roll of paper
- 1 carrying 5trap 1 ink ribbon 1 manual
- 1 guarantee certificate

4.9 ACCESSORIES

PINZA 400A/0,4V-DC **ref. 4MB T**
PAC 400 clamp meter for DC measurements.
- For connection to VIP MK3/VIP SYSTEM3 through ADAPTA 1 V/1 V adapter
- Measuring range: 1 to 400A
- Note 1

PINZA 500A/0,5V-AC/DC **ref. 4MBU**
PAC 500 Clamp meter for DC and AC measurements.
- For connection to VIP MK3/VIP SVSTEM3 through ADAPTA 1V/1V adapter
- Measuring range: from 0, 1 to 500A
- Note 1

PINZA 1000A/1V -AC-DC **ref. 4AABW**
PAC1000 Clamp-meter for DC and AC measurements.
- For connection to VIP MK3/VIP SYSTEM3 through ADAPTA 1V/ 1V adapter
- Measuring range: from 1 A to 1100 A for D.C. from 1 A to 800 A for A.C.
- Note 1

PINZA-US2C.O2 **ref. 4MB V**

US2C.02 Clamp meter for AC and DC measurements.
- For connection to VIP MK3/VIP System3 through ADAPTA 1V/1V adapter + two wires with banana plug.
- Measuring range: from 1 to 600 Amp for D.C.; from 1 to 800 Amp. for A.C.
- Note 1

PINZA 1000/1-D5 **ref. 4AAC2**
D5 Clamp meter for A.C. measurements.
- For connection to VIP MK3NIP SVSTEM M3 through INTA/1 adapter
- Measuring range: 1 1000 Amp.
- Note 1

PINZA 3000/1-D6 **ref. 4AAC3**
D6 Clamp meter for A.C. measurements. For connection to VIPMK3NIP SVS- TEM 3 through INTN1 adapter. -Measuring range: 1 3000 Amp. -Note 1

ADAPTA-1V /1V **ref. 4AACQ**
1V /1V CLAMP METER adapter Clamp meter input adapter with Volt output and banana pins.
- Note 1

INTA/1 **ref. 4AABB**
INTERFACE FOR CT -CLAMP METER/1A Interface far current transformer (TA) or Clamp meter with 1A. secondary
- Features: 1A Input/ 1v output/ Accuracy 0.2%
- Note 1

INTA/5 **ref. 4AABD**
INTERFACE FOR TA -Clamp meter/SA Interface for current transformer (TA*)* or clamp meter with SA secondary
- Features: SA Input/ 1V Output/ Accuracy 0.2%
- Note 1

CAVO-PINZA **ref. 4AACR**
TWIN-CABLE WITH BANANA PLUGS Cables for Cables for connection to clamps with bush Output to interfaces: INTA/ 1.INTA/5. ADAPTA 1V/1V -Note 1

Note 1 -requires 1 piece far single-phase measurement 2 pieces for Three- phase measurement with out neutral wire; 3 pieces far three-phase measurement with neutral wire.

PUNTALE-XPP-80/U **ref. 4MBR**
VOLTAGE MEASUREMENT PROBE up to 1000v(AC-DC)
For connection by 1000v measuring cable -Note 2

PUNTALE-XPS-1801 A **ref. 4MBS**
VOLTAGE MEASUREMENT PROBE up to 1000v(AC-DC)
For connection by 1000v measuring cable -Note 2

COCCODRILLO-GRIP-C **ref. 4MBY**
VOLTAGE MEASUREMENT PROBE up to 1000V -Note 2

COCCODRILLO-GRIP-D **ref. 4MBO**
VOLTAGE MEASUREMENT PROBE up to 1000V -Note 2

CAVO-MISURA-1000V **ref. 4MBG**
SET OF CABLES for 600Vms three-phase grounded lines (Max 1000V phase- phase).

INTERFACE-MK3-LMA **ref. 4MCO**
INTERF;MK3-LMA IL VIP MK3 enables measurement of leakage current with in a load group or in a single machine.

CLOSED DIFFERENTIAL TOROIDS

TN30 Toroid diameter 30 mm **ref. PMAAW**
PN50 Toroid diameter 50 mm. **ref. PMAAX**
MN120 Toroid diameter 120 mm. **ref. PMAAY**
SN200 Toroid diameter 200 mm. **ref. PMAAV**

OPENABLE DIFFERENTIAL TOROIDS

PO 046 Toroid diameter 46 mm. **ref. 2WAN8**
GO 110 Toroid diameter 110mm. **ref. PMML**

Note 2 Requirements:
2 pieces for single-phase measurements;
3 pieces for three-phase measurements without neutral wire;
4 pieces for three-phase measurements

FBC1 **ref. 4AACS**
FBC1 RAPID BATTERY CHARGER for rapid charging of batteries inside the VIP SYS3 and VIP MK3. -Feed voltage 230 VA 15%. -Power 18 VA - Output voltage 6V. -Output current 1 .5 A.

CAVO-RS232-EPSON **ref. 4AACW**
Connecting cable between the RS232 serial output of the VIP MK3/VIP SYS3 and the Epson or compatible printer.

CAVO-RS232- IBM -PC **ref. 4AACF**
Connecting cable between the RS232 serial output of the VIP MK3/VIP SYS3 and a Personal Computer with a standard 25 pole RS 232 (XT)

CAVO-ADAPT-25P-9P **ref. 4AACM**
25 -9 pole adapter to be used coupled to CABLE RS232 IBM-PC for connection to a personal computer with 9 pole RS232 output *(AT)*

CAVO-RS232-MODEM **ref.4AACN**
Connection cable between RS232 serial output of VIP MK3/VIP SYS3 and a modem.

COMMUNICATION SOFTWARE
A program far connecting the VIP MK 3/ VIP SYS3 to an IBM or compatible Personal Computer.

VIP3-COM.DISK-15,1/4 **ref. 4AACT**
Italian version on 5"1/4 disks (STANDARD)

VIP3-COM.DISKUK5,1/4 **ref. 4AAB8**
English version on 5"1/4 disks (STANDARD)

VIP3-COM.DISK-13,1/2 **ref. 4AACV**
Italian version on 3"1/2 disks (ON REQUEST)

VIP3-COM.DISKUK3,1/2 **ref. 4AACU**
English version on 3"1/2 disks (ON REQUEST)

DSC-MT **ref. 4AAC4**
Delta Star converter far medium voltage connection

SYSTEM3 EXPANSIONS

MEMORY-PACK-128K **ref. 4MBF**
MEMORY PACK: data storage for measurement data. The MEMORY PACK stores measurements of all sample quantities (electric and others) and holds them until they are transferred. Its 128 K memory enables it to store up to 649 measurement records.

MP-PI-1 **ref. 4MCP**
PARALLEL INTERFACE for Memory Pack control.

BLACK-BOX-PYROMETER **ref. 4MB9**
BLACK BOX PYROMETER FOR HOT SPOT DETECTION The BLACK BOX connected to the VIP SYSTEM 3 is used for measuring the temperature of objects without coming into contact with them, by exploiting the principle of passive infra-red ray reading. Measuring range -20° + 200°C Use tempera- ture 00-50°C Accuracy 1°C

BLACK-BOX-LMA **ref. 4MCA**
The VIP SYSTEM 3 coupled to the Black Box Lma makes it possible to measure leakage current in an electrical system. in a group of load points. or even in a single machine.

BLACK-BOX-CENTRONICS **ref. 4MCX**
The CENTRONICS BLACK BOX enables a remote parallel printer using a "CENTRONICS" type protocol to be connected to the VIP SYSTEM 3.

CAVO CENTRONICS **ref. E1ADV**
STANDARD CENTRONICS CABLE for connecting Centronics BLACK BOX to parallel printer.

BLACK-BOX -MULTIFUNCT **ref.4MCS**
BLACK BOX MULTIFUNCTION coupled to the VIP SYSTEM 3 enables measurement of Temperature, relative Humidity, Sound Level and Light. It can be used coupled (one at a time} to any of the following sensors, which are NOT INCLUDED.

SENS. THERMOMETER **ref. 4AAC9**
THERMOMETER
RECOMMENDED for measuring temperature of rooms and objects. Measuring range:-200°C to + 800°C -Accuracy + /-1°C.

SENS.HYGROMETER **ref. 4AAC8**
HYGROMETER
RECOMMENDED for measuring indoor humidity.
Measuring range from, + 5% to 95% Measuring Accuracy + /-0.~/o.

SENS.SONOMETER **ref. 4AAC7**
SOUNDMETER
RECOMMENDED for measuring indoor noise.
Measuring range from 40 to 130 DB -Accuracy + /- 2 DB
-Passband from 25 Hz to 25KHz

SENS.LUXMETER **ref.4AAC6**
LIGHTMETER
RECOMMENDED for measuring indoor light. -Measuring range from O to 2,000 LUX, from 0 to 200,000 LUX (with incident light corrector) - Definition 1 LUX within range of 0 to 2000 LUX. -0,2% of reading.

SPARES

- **CONF.10 FUS-VIP3.110V** **ref. 4AABP**
  Package containing 5x20/160mA 250V RIT fuses
- **CONF.10 FUS.VIP3-220V** **ref. 4AADF**
  Package containing 5x20/80mA 250V RIT fuses
- **CONF.10-CARTA-X-VIP3** **ref. 4AABO**
  Package of 10 paper rolls for VIP3
- **NASTRO-EPR-ERC.O9C** , **ref. 4AABH**
  Ink Tape
- **PINZA-1000A/1V-AC** **ref. 4AAA6**
  Clamp meter 1000A/
- **VIP3-CAVO.VOLT** **ref. 4AAB2**
  1 power feed cable
- **MICROVIP-BRETELLA** **ref. 4AAAI**
  1 shoulder-bag
- **MK3-V ALIGIA.AMERICA** **ref. 4AAB3**
  1 carrying case for MK3 Kit.
- **SYS 3.V ALIGIA-R6-ALL** **ref. 4AAB4**
  1 carrying case for SYSTEM 3 Kit

4.10 MEASUREMENTS WHICH CAN BE CARRIEO OUT ANO THEIR SYMBOLS

Symbol	Description
V-Σ:	Equivalent voltage for a three-phase symmetric system
V-1N	True voltage between R phase and neutral
V-2N	True voltage between S phase and neutral
V-3N	True voltage between T phase and neutral
V-12	True voltage between R phase and S phase
V-23	True voltage between S phase and T phase
V-31	True voltage between T phase and R phase
A-Σ:	Equivalent current of a symmetric and balanced three-phase system.
A-1	R phase true current
A-2	S phase true current
A-3	T phase true current
A-N	N phase true current
kW-Σ	Three-phase system active power
Kw-1	R phase active power
Kw-2	S phase active power
Kw-3	T phase active power
CoSφ	Three-phase system power factor
CoSφ	1R phase power factor
CoSφ	2S phase power factor
CoSφ	3 T phase power factor
	If the CoS4> = 1 the sign should not appear
KW-Σ	Average three-phase system active power
Kw-1	Average R phase active power
Kw-2	Average S phase active power
KW-3	Average T phase active power
KVA-Σ	Three-phase system apparent power
kVA-1	R phase apparent power
kVA-2	S phase apparent power
kVA-3	T phase apparent power
KVA-Σ	Average three-phase system apparent power
kVA-1	Average R phase apparent power
kVA-2	Average S phase apparent power
kVA-3	Average T phase apparent power

kVAr-Σ	Three-phase system reactive power
KVAr-1	R phase reactive power
KVAr-2	S phase reactive power
KVAr-3	T phase reactive power
KVAr-Σ	Average three-phase system reactive power
KVAr-1	Average R phase reactive power
KVAr-2	Average S phase reactive power
KVAr-3	Average T phase reactive power
%-Σ:	Three-phase system percentage harmonic distortion
%-1	Average R phase percentage harmonic distortion
%-2	Average S phase percentage harmonic distortion
%-3	Average T phase percentage harmonic distortion
kWh- Σ	Three-phase system active energy consumption
kWh-1	R phase active energy consumption
kWh-2	S phase active energy consumption
kWh-3	T phase active energy consumption
KVArh-Σ	Three-phase system reactive energy consumption
kVArh-1	R phase reactive energy consumption
kVArh-2	S phase reactive energy consumption
kVArh-3	T phase reactive energy consumption
CoSφ	Average three-phase power factor
CoSφ	Average R phase power factor
CoSφ	Average S phase power factor
CoSφ	Average T phase power factor
Tg.φ-Σ	Average three-phase tangent
Tg.φ-1	Average R phase tangent
Tg.φ-2	Average S phase tangent
Tg.φ-3	Average T phase tangent

Possible exponents (All the units of measurement below take into consideration the maximum KA and KW value which can be preset during the SET-UP phase).

rnV V kV
mA A kA
m W W kW M W GW
rnVA VA kVA M VA GVA
rnVAr VAr kVAr MVAr GVAr

Measurements are expressed with a maximum of 4 and a minimum of 3 figures.

E.g.: 100,000 <--100.0 K
10,000 < --10.00 K
1,000 < --1000
100 <--100.0
10 < --10.00
1 < --1.000

The display removes meaningless zero's down to the last one before the decimal point.

E.g.: 32.5 < --32.5 (NOT 032.5)
0 < --0.0 (NOT 000.0)

4.11 FORMULAS USED

Formulas used for single phase measurements

Instantaneous effective voltage	$V_{1N} = \sqrt{\frac{1}{n} \cdot \sum_{1}^{n} (V_{1N})_i^2}$
Instantaneous active power	$W_1 = \frac{1}{n} \cdot \sum_{1}^{n} (V_{1N})_i \cdot (A_1)_i$
Instantaneous power factor	$\cos\phi_1 = \frac{W_1}{VA_1}$
Instantaneous effective current	$A_1 = \sqrt{\frac{1}{n} \cdot \sum_{1}^{n} (A_1)_i^2}$
Instantaneous apparent power	$VA_1 = V_{1N} \cdot A_1$
Instantaneous reactive power	$VAr_1 = \sqrt{(VA_1)^2 - (W_1)^2}$

Formulas used for three-phase measurements

Equivalent three-phase voltage	$V_\Sigma = \frac{V_{12} + V_{23} + V_{31}}{3}$
Three-phase reactive power	$VAr_\Sigma = (VAr_1 + VAr_2 + VAr_3)$
Reactive power for PFC to the tgφ corresponding to the preset cosφ	$VArd_\Sigma = VAr_\Sigma - [W_\Sigma \cdot tg\phi(\text{set up})]$
Equivalent three-phase current	$A_\Sigma = \frac{VA_\Sigma}{\sqrt{3} \cdot V_\Sigma}$
Active three-phase power	$W_\Sigma = W_1 + W_2 + W_3$
Three-phase apparent power	$VA_\Sigma = \sqrt{W_\Sigma^2 + VAr_\Sigma^2}$
Equivalent three-phase power factor	$\cos\phi_\Sigma = \frac{W_\Sigma}{VA_\Sigma}$

Symbol comparison table

Symbols used in the formulas	Corresponding instrument symbols
V_{1N}, V_{2N}, V_{3N}, V_Σ	V-1N, V-2N, V-3N, V-Σ
V_{12}, V_{23}, V_{31}	V-12, V-23, V-31
A_1, A_2, A_3, A_Σ	A-1, A-2, A-3, A-Σ
W_1, W_2, W_3, W_Σ	W-1, W-2, W-3, W-Σ
VA_1, VA_2, VA_3, VA_Σ	VA-1, VA-2, VA-3, VA-Σ
VAr_1, VAr_2, VAr_3, VAr_Σ	VAr-1, VAr-2, VAr-3, VAr-Σ
$\cos\phi_1$, $\cos\phi_2$, $\cos\phi_3$, $\cos\phi_\Sigma$	cosφ-1, cosφ-2, cosφ-3, cosφ-Σ

5 USE and MAINTENANCE

5.1 WARNINGS and RECOMMENDATIONS

For correct use and maintenance the following should be observed:

1) The instruments are designed to operate with mains power supply, or for brief periods, with the built-in battery.

2) The battery is automatically charged when the instrument is connected to the mains power supply. It take about 48 hours to completely recharge. For this the power switch should be on "STANDBY".

3) For the rapid battery recharging the FBC1 battery recharger should be used, which completely recharges in less than 2 hours.

4) The "ON/STANDBY" switch does not interrupt the mains power supply but stops power supply to the low voltage circuits.

5) When operating an battery power, the writing "BATT." is displayed in negative, under the writing "ELCONTROL" an all at the measurement pages (tram pages 1 to 15)

6) If switched to "ON" when there is no mains supply the following will appear on the display in this order:

   a) All of the different characters which can be displayed will fill the display screen,then
   b) TEST OK, then
   c) "Memory Pack not present", or "Memory Pack present". "Black Box not present", or "Black Box present". then d) Page 1 with the writing "BATT".

In addition, the following is printed out:

POWER OFF	dd mm yy h m s
POWER ON	dd mm yy h m s
MAINS INTERRUPTION	dd mm yy h m s

The date and time given are those when the operation took place.
The writing "MAINS INTERRUPTION" indicates that there is no mains power supply.

7) Switching to "ON" with mains power supply connected, the same images in the same order as in paint 6 above will appear an the display, except far part "D",

In addition, the following information will be printed out:

POWER OFF	**dd mm yy h m s**
POWER ON	**dd mm yy h m s**

The foct that there is no writing that refers specifically to the mains means that it is being power supplied by the mains.

8) When there is a mains Microinterruption lower than a second, the following will be printed out:

MICROINTERRUPTION dd mm yy h m s XXXms

When a mains interruption lasts more than 1 seconds the following will be printed out:

MAINS INTERRUPTION dd mm yy h m s MAINS RETURN dd mm yy h m s

9) Each time that it switched from "STANDBY" to "ONII an "AUTO DIAGNOSIS TESTII is carried out to verify that it is functioning properly.
In case of an internal malfunction one of the following messages will be displayed:

ERROR 1 H The test on the "RAM USER'S" memory indicates that the RAM itself has been damaged. Contact ELCONTROL TECHNICAL ASSISTANCE.

ERROR 2H Indicates a printer malfunction. Contact ELCONTROL TECHNICAL ASSISTANCE.

ERROR 3H Indicates a malfunction in the measurement circuits. Contact ELCONTROL TECHNICAL ASSISTANCE.

LOW BATTERY Will display this message when it is switched on if the battery is discharged. If there is no printout within 1 minute, this means it must be connected to the mains for at least a day, or connected to the rapid battery charger.

MEMORY PACK NOT CORRECT! RESET? 0 = YES ; 1 = NO
This writing appears only when a Memory Pack is inserted which contains significant data, but which contain errors. It can be immediately reset, or a printout can first be made.

10) Check regularly and frequently that there is sufficient paper and the condition of the ink ribbon. If the printer function without paper it will rapidly deteriorate.

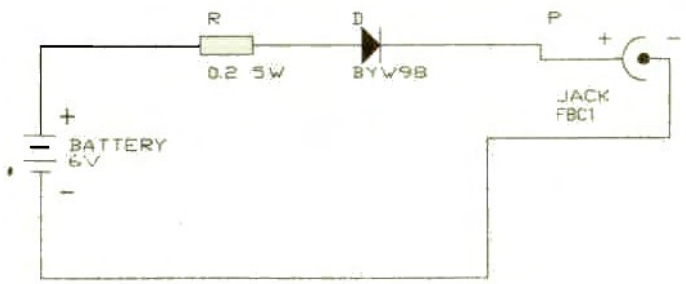
5.2 TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	SOLUTION
Display off	Switch positioned on "STANDBY"	Position switc on "ON"
	Contrast not regulated	Turn "Display Contrast regulatored
Display light off	Programmed "Always Off"	Programmed "Always Off"
Does not print in automatic		
Does not carry out voltage measurement	Battery low	Battery low
Does not carry Out voltage measurements	Measurement cable not connected properly. Measurement cables damaged.	Measurement cable not connected properly. Measurement cables damaged.
Phase angles powers and other derived measurements not coherent	Clamp meters and volt-metric plugs not coupled	Clamp meters and volt-metric plugs not coupled
Alarms do not Intervene properly	Incorrect alarm pro-gramming.	Incorrect alarm pro-gramming.
Serial connection does not function	Inappropriate RS232 programming	Inappropriate RS232 programming
	Parameters to be printed not programmed	Parameters to be printed not programmed

PROBLEM	POSSIBLE CAUSE	
Time Bands do not correspond	Incorrect programming	Reprogram
	Clock incorrect	Reset clock
Auxiliary para-meters not functioning	Specific Black Box.	
	Incorrect programming	Reprogram correctly
Data collection not functioning	Memory Pack insert improperly or missing	Insert Memory Pack correctly Verify on display
	Incorrect programming	Reprogram correctly

APPENDIX 1

VIP MK3/SYSTEM3 POWERING USING EXTERNAL BATTERY SOURCE



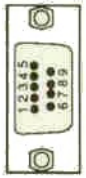
Choose a suitable 6 V battery depending upon the usage time required.

Using an external battery with a rating of 4 Ah, the VIP SYSTEM 3 / MK3 will function for 8 hours without printer, but for 4 hours with printer printing continuously.

The cable must be at least 1 mm2 and the cable length should not exceed 50 cm due to cable voltage drop.

Connection to HOST COMPUTER
For IBM AT type

VIP



PIN	FUNCTION	PIN
1	DCD	N.C.
2	RX	3
3	TX	2
4	DTR	6
5	GND	5
6	DSB	4
7	RTS	8
8	CTS	7
9	N.C.	N.C.

COMPUTER HOST (AT)